

PHILOSOPHICAL
Transactions:
GIVING SOME
ACCOMPT
OF THE
Present Undertakings, Studies and Labours
OF THE
INGENIOUS
IN MANY
Considerable Parts
OF THE
WORLD.

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SMITHSONIAN
INSTITUTION

VOL. VII.

For the Year MDCCLXXII.

LONDON,

Printed by T. R. for John Martyn at the Bell in St. Pauls
Churchyard, Printer to the ROYAL SOCIETY.

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TO THE
RIGHT HONOURABLE
ARTHUR
EARL of ANGLESEY

One of the LORDS of His Majesties most Honourable
Privy Counsel, &c.

My Lord,



YOUR Lordships many favours towards me, and mine own engagements to record the modern Resuscitations and Advancements of the Philosophical Sciences, for which you have alwaies shew'd a more than Ordinary propension, do, in all respects, both oblige and encourage me to dedicate this Volume of Philosophical Transactions to your Lordship.

My Lord, it hath been reported, that Philosophy and all kinds of polite Literature have commonly retired to the obscurest recesses, for shelter from the noise of War, and have expired or been almost extinguish'd by publick Calamities. But these our Generous Philosophers, whom I have devoted my services to, held out in all the Combustions of our former Wars, when our potent Neighbors assaulted us on all sides, and when the Pestilence and Fire had wasted our Mother City. And they brought in not a few additions of Materials and Aids, to all that had been essay'd in former Ages, or had been invented or prosecuted by the modern enterprizes of those admirable Men, our Gilbert, Galilæus, our Lord Bacon, Peyreske, Torricellius, Gassendus, Des-Cartes, Harvey, and many others worthy of everlasting monuments. These were bright Stars of the first magnitude; yet their greatest Designs were lately illustrated, enlarged, methodized, and, some way or other, improved to more maturity and perfection; as may be seen in the History of the R. Society, and sometimes more particularly in the rude Miscellanies of these Transactions.

So much have the noblest Arts flourish'd amongst us ever since His Majesties most auspicious Restauration (partly by the recovery of Antiquities, partly by recent aides, and successful Inventions,) even in these roughest times of publick conflicts, that it may remain for a sufficient proof, that this Practical Philosophy is not an effeminate or effete study,

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study, but efficaciously serviceable, under the heaviest incumbrances, as well for the defence of our King and Country against hostile Invasions and Encroachments, and for supply of necessaries for life, health, and strength in War, as for Accommodations, Elegancies and Ornaments in times of Peace and Prosperity.

'Tis manifest, that the Mathematical and Mechanical Arts are no less seasonable in these our Collisions for the skill and security of Navigation; and for Naval Architecture; for Engins, Fortifications, Artillery, and the modern Tactics: Medicine and Chirurgery for the recovery of decayed health, and the healing of lost or wounded limbs; Agriculture for sustenance; and, in remembrance of the old Heroes, I may add Martial Music, to excite Courage; and other Old and New Inventions proper to furnish other advantages: Then softer Delicacies are fit for treatments, satisfactions and political endearments in the establishment of safe and peaceable Government. An Archimedes may as justly deserve applause for his stout defence of Syracuse, as Phidias for the tender touches of his Chisel in fashioning the Pourtraitures of Jupiter and Minerva.

And 'tis by the Intelligent acknowledged, That there are, at this day, a great number of more excellent Artificers, in almost all kinds of Works, which are deduced from the Ingenuous Arts, for strength and beauty, and for all necessaries and all curiosities, than, I think, were ever before seen in England; and that these Arts could not have grown so soon to such height, if his Majesties extraordinary Magnificence and the Public Exigences had not concurr'd to excite almost an Universal Industry. By the divine conduct, immediately after His Majesties return, his Countenance and his own great Example in Repairing and Adorning his Royal Palaces, and in strengthening and increasing his Navy; and his Royal Grant of a Charter to establish the Royal Society (according to Cicero's sentence, Honos alit artes:) All these encouragements made the way, and prepar'd skilful Masters and Guides, to survey, direct and promote all splendid Structures and Embellishments, which are now so conspicuous in the chief places of this Kingdom; and the abundance of goodly Ships, which do now ride in all our navigable Rivers and in all our Seas.

But I must decline a Task too hard for my pen, and too great for my leisure; and shall humbly present before your Lordships eye a closer and shorter view of some particulars contain'd in this small Volume. Astronomy, and other chief parts of the Mathematicks; and a diligent search into the depths of nature, into the nature of Animals, Vegetables, and all Simples, Compounds and Mixtures, were the business, and in
some

some manner appertain'd to the devotion of the Mighty Monarchs, Patriarchs and Wise men of the East. Here we have an account of several Novelties in the Heavens, and Changes in the Fixed Stars; the Orbits of the Planets, and the Periods of their rotations, in a sure way to be ascertain'd to the minutest measures of Time and Place. A Comet was seen, though but by a few, in the Spring of this Year; Here his appearances and motions are diligently calculated. The Abstrusities of Mathematicks in several points rendred easie. Brief and easie methods of Tangents for many uses. Algebraical additions, and a Body of Algebra under hand. Music open'd Philosophically, Mathematically and Practically. Opticks gave us the advantage above our Ancestors for the view of things present and at remotest distance: Here we are offer'd fresh accomp'ishments of Opticks and Perspective; and a Reflecting Telescope, which promisetb and is like to perform more than has hitherto been attained by any approaching proportion of Measure. Light and Colors shew us all the beauty of this our world: much hath been done lately, with great success, to indicate the nature of both, beyond all expectation. And here we have second Advises of the nature of both; that Light is not absolutely pure, but heterogeneous; Whiteness not simple, but an Aggregate of all Colors. Light resulting from dead-flesh, both before it be sensibly putrified, and when it is putrified. Here Anatome searches near to the Originals of Animal-propagation, and of human contexture; dissects also the Veins of Vegetables, and there finds something analogous to Blood and Sence. Our Scarborough-Spaw is again anatomised spagyrically: And the Aponensian Baths of Italy, long ago admired by Livy and Claudian, are here re-examin'd. Common Stones are required to shew the Causes and Cure of the tormenting Calculus; concerning which here is found an instance of one bred under the tongue of a man. The Origin and Virtues of Gems are carefully discuss'd. Chymistry is here freed from the smuttiness of smoking vapors, performing much without fire, meerly by curious waies of Digestion, Fermentation, and Grinding. The Medicines of best note, and tryed, extracted out of 117 Authors, and reduced to an Alphabet of 410 Diseases. Here is a learned Account of the late Plague in London; of the Epidemical and Vernaculous Diseases of England and Wales; the peculiarity of our Air, Soil and Water: Also a Work of Chirurgery and Anatome, with a Breviate of the Plague in Holland.

Here Botaniques are discriminated, ranged, and explicated by the most Essential indications of Nature. The Culture of Vegetables appropriated for Orchards by one; and by another enlarg'd from the Flowry Garden to the Common fields and pastures. New England and the

the other English Plantations in America acquaint us with their Vegetables and other rarities, chiefly for Medicine and Chirurgery. Kermes found to be in England, and Cochineil a kind of Kermes. The dancing Poyson of the Tarantula-Spider and the Muscal cure disbeliev'd in Otranto and Calabria, their proper places. The manner how the bitings of Vipers do poison, with great diligence examin'd in Italy; their result more than once contradicted in France. The Lake Lemain, and the Rhine runing through it; some Fish Canonizing there, some Wanderers, and many remarkables, accurately described. The Winds, in all their guises, by Sea and Land traced to their Originals. Prognosticks, Remedies or Preventions of Dearth and mortalities propos'd. Registers of Weather past, of price of Corn, human Births and Burials, solicited.

Here are some elaborate researches made into the Prerogative of Mans Mind; the pretences to knowledge in Beasts; the Souls of Brutes; the manner of Sensation, and Animation; into all the curious Motions in nature, perceptive, appetitive, vital. The poysses of Gravitation are here weigh'd in Philosophical Scales both relatively and positively. The operations, which the varying Weight of the Atmosphere may have even upon Mens Sickneß or health, are inquired into.

And for Voyages, a Parisian hath begun to give us the fourth Part of his Collections, relating to the Spanish Provinces in America: And two English Travellers have enricht us with their Observations of the Low-Countries, France, Germany, Helvetia, Grisons, Italy, Sicily, Malta and Spain. General Geography compleated beyond what others were aware of.

My Lord, I am sensible, I have gone beyond the bounds of an Address, presuming on your Lordships patience, whilst I endeavor (as in your presence) to satisfie such as are pleas'd to accept of the best satisfaction I am able to offer, and which is, I think, sufficient to prove, that knowledge grows on daily, more and more, and that our motion perseveres to be progressive. And your Lordship well knows, (and our Registers partly publish'd, partly reserv'd, do testifie it,) that the Designs of his Majesties Royal Institution receive good assistance and applause from the most Eminent in the chief parts of the World, and is either encourag'd or emulated by most of the Kings and Princes in Europe. May this Royal Society, and the Noble Sciences ever flourish; and may your Lordship, and all, that favor these obliging Designs, ever prosper. So wisheth,

My Lord,

Your Lordships

Very humble and obedient Servant,

Henry Oldenburg, Soc. Reg. Secr.

Fig. V.

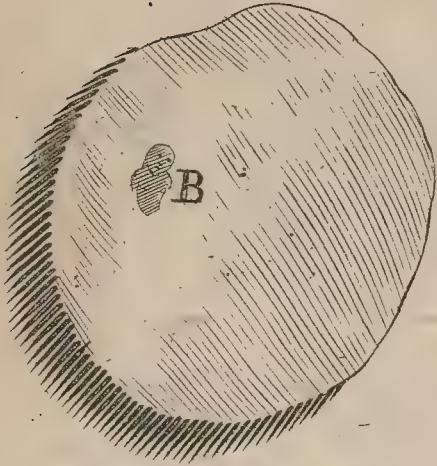


Fig. II.



Fig. I.

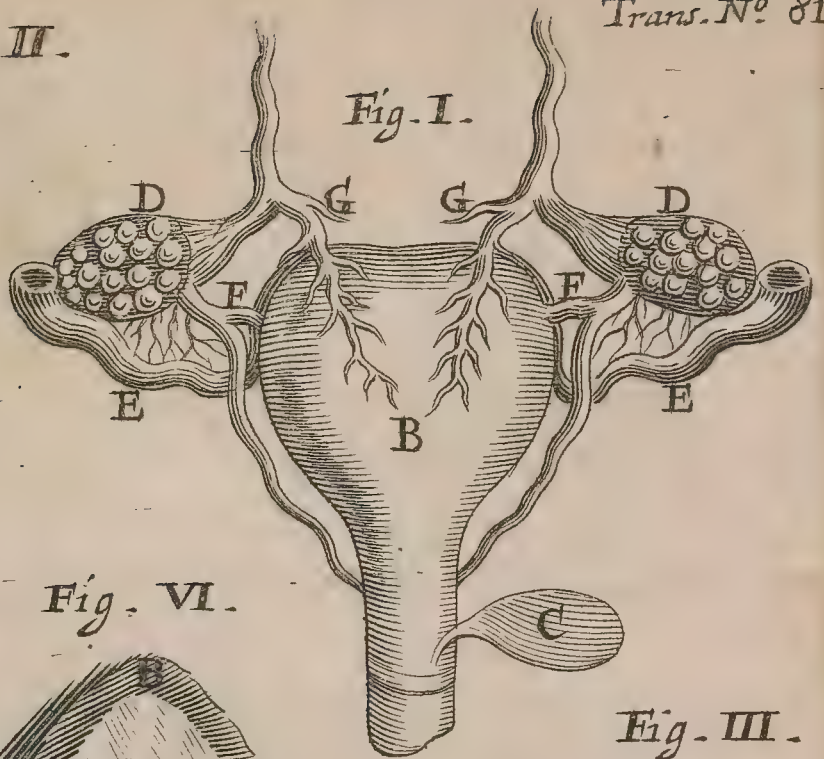


Fig. VI.

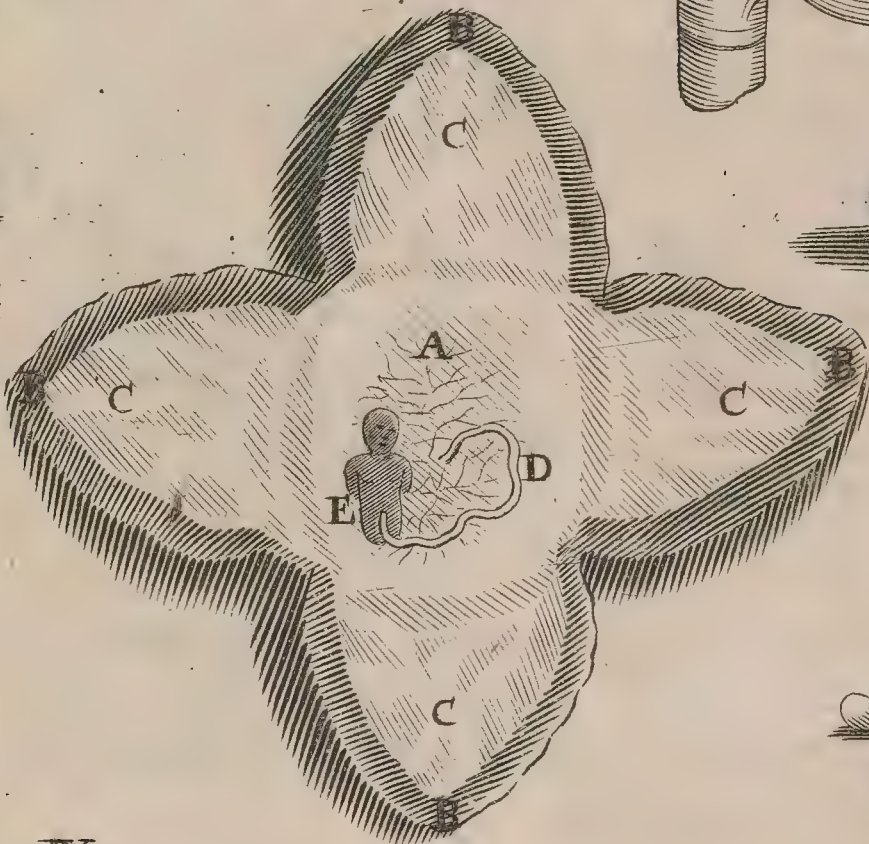


Fig. III.

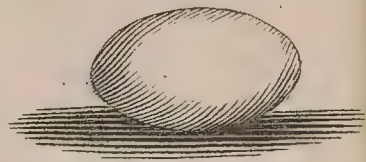


Fig. IV.



Fig. IX.

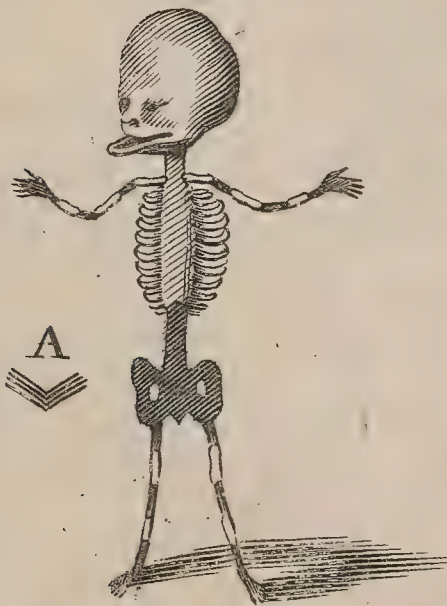


Fig. VIII.

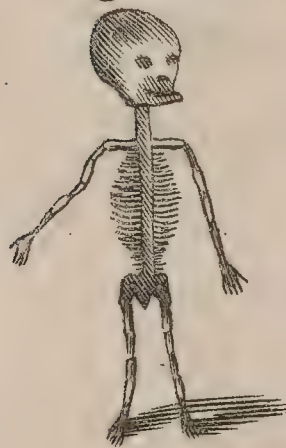
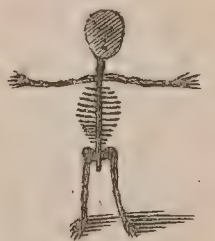
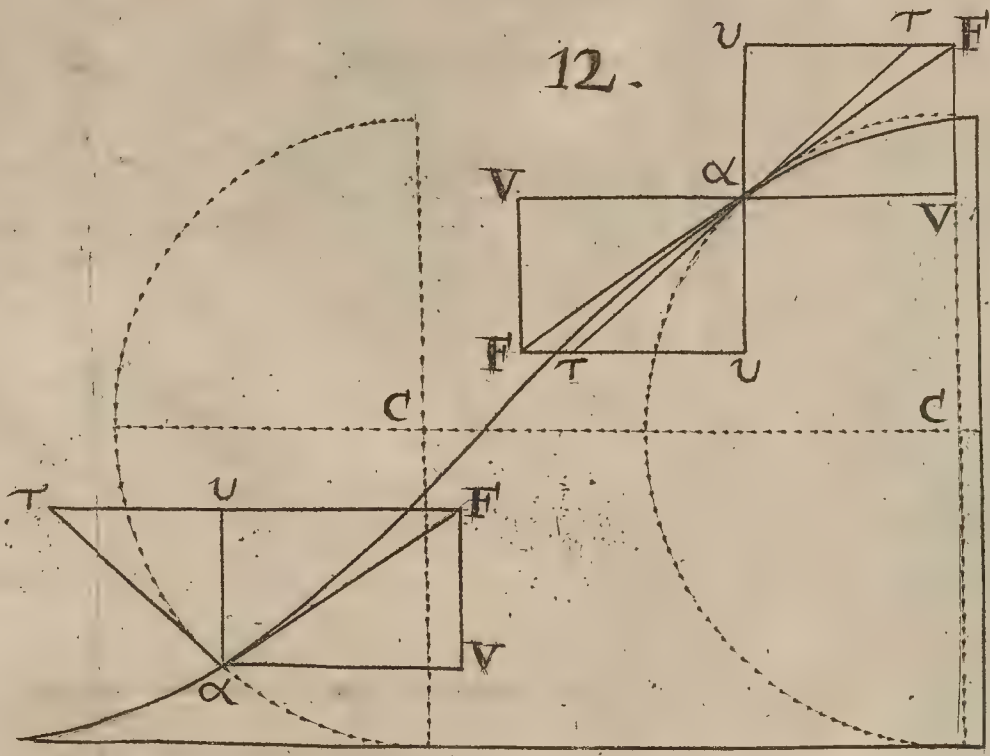
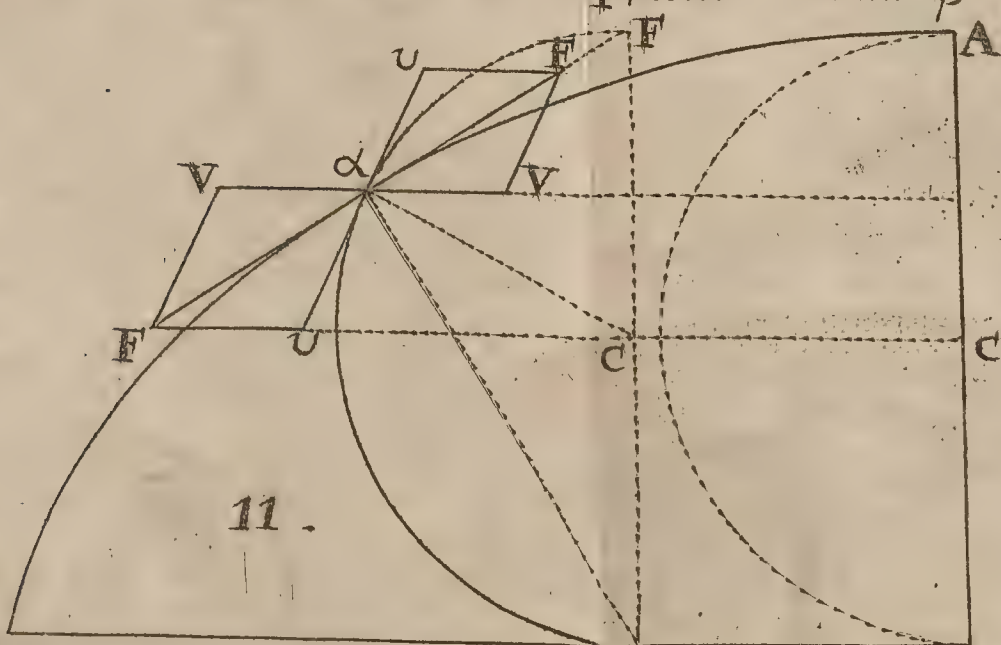
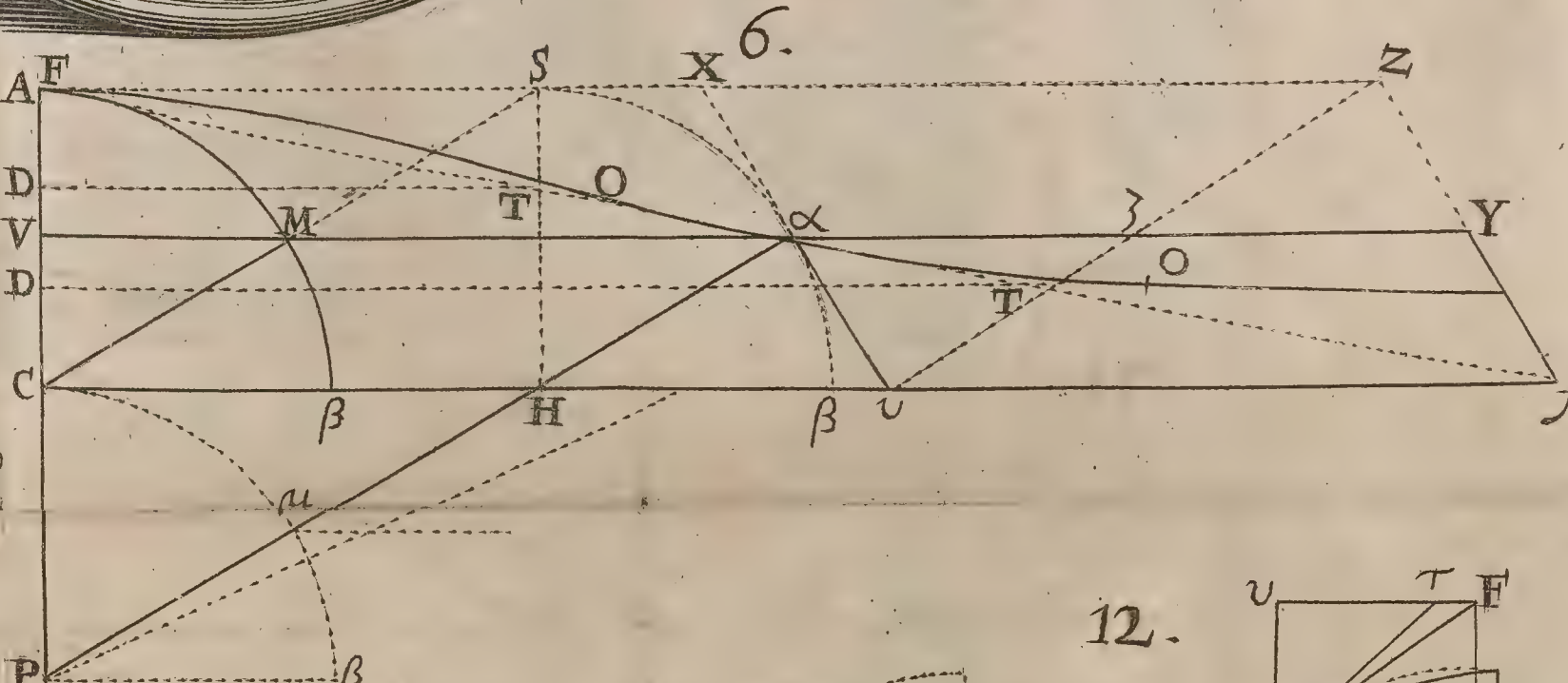
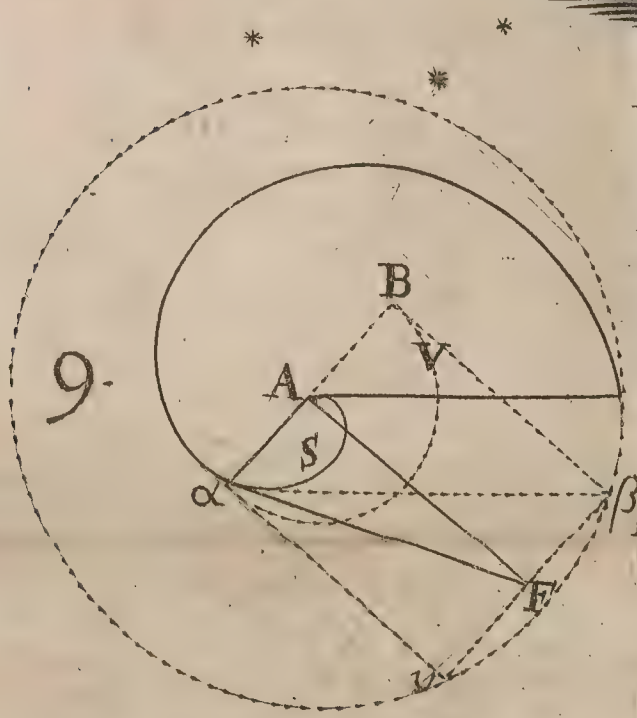
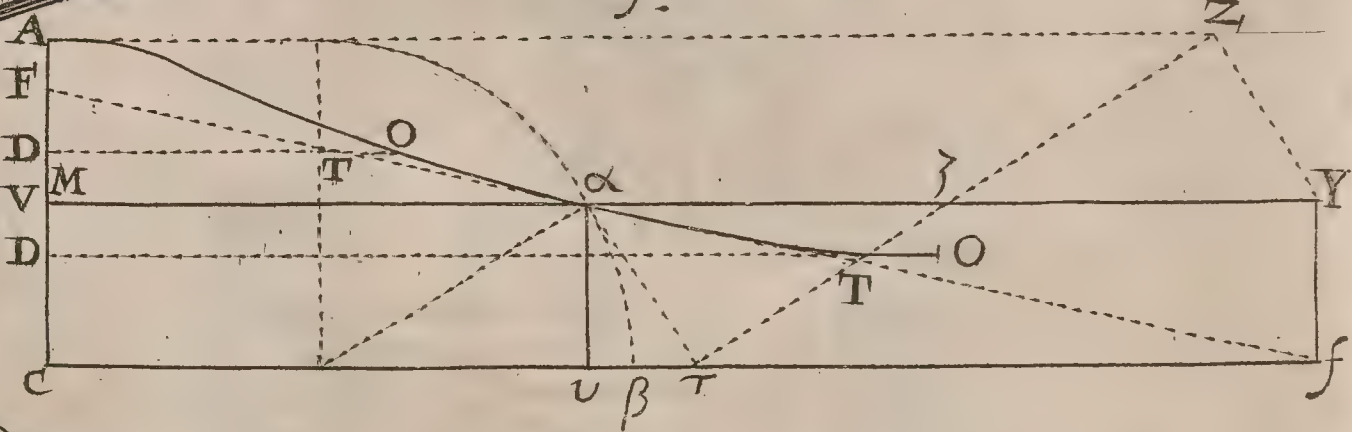
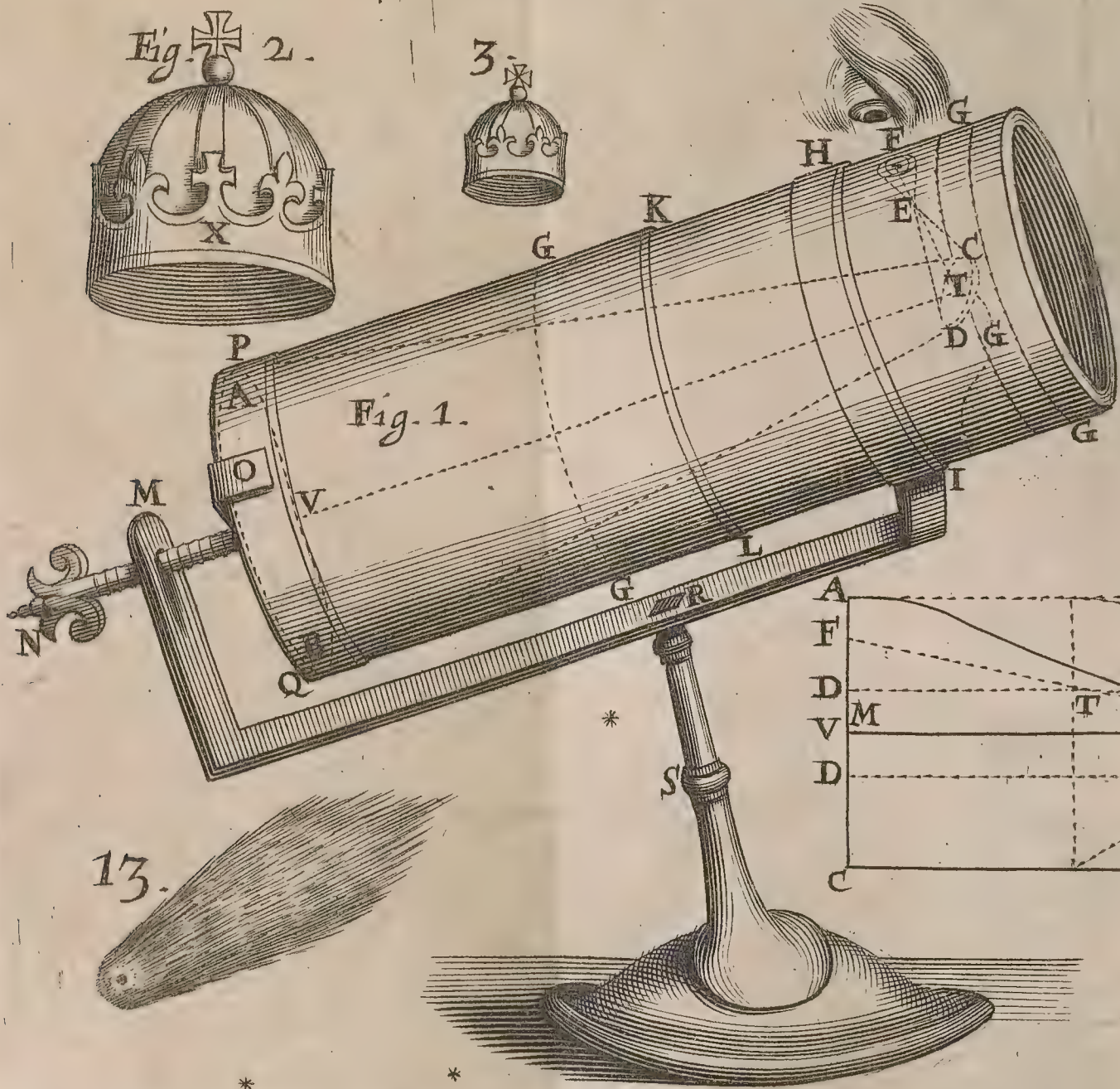
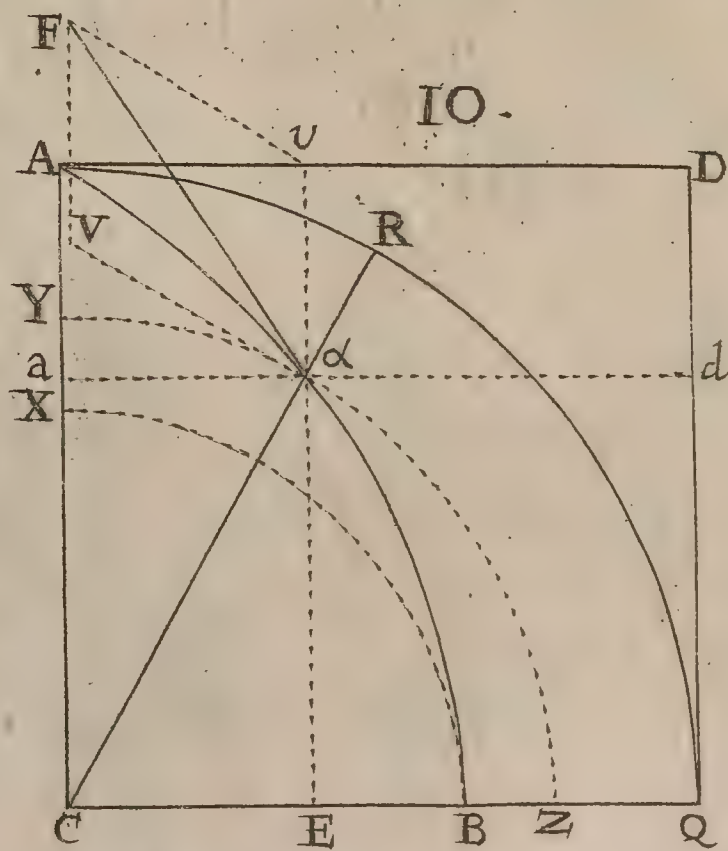
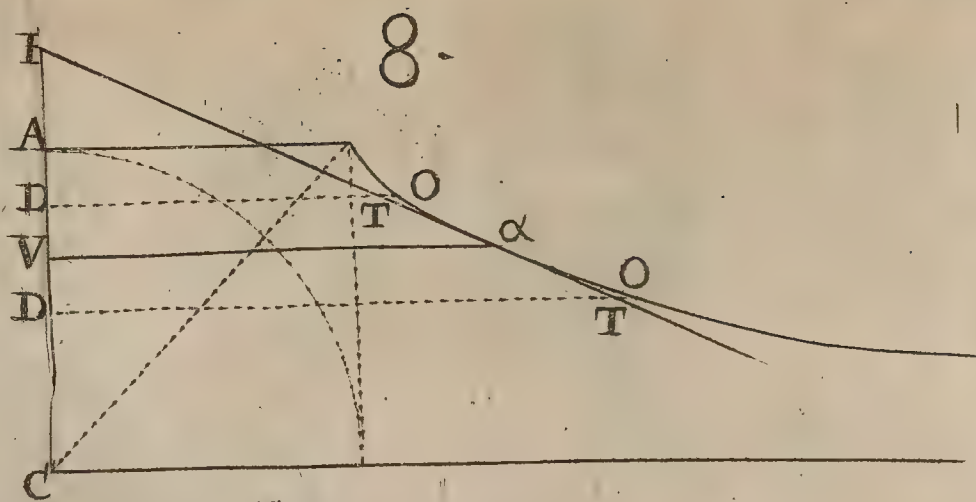
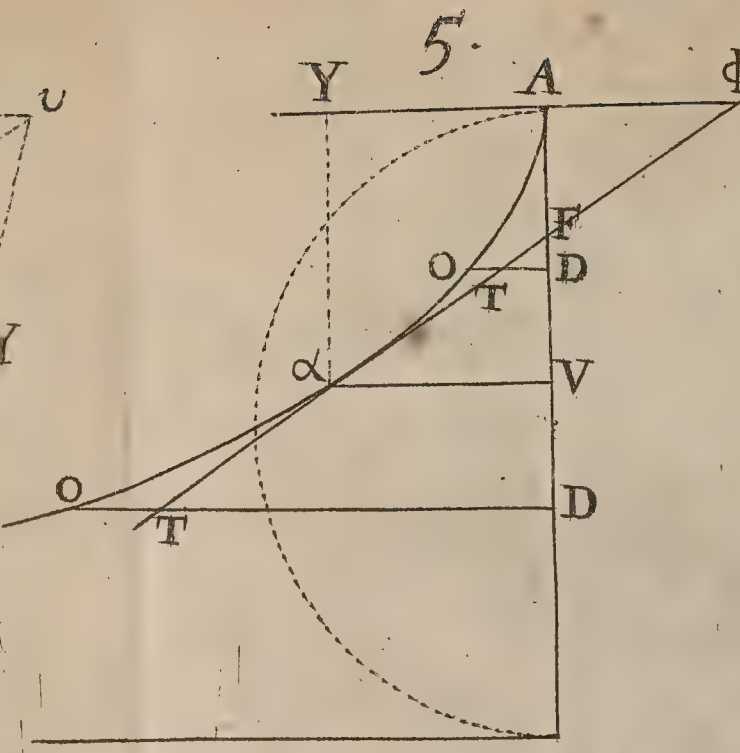
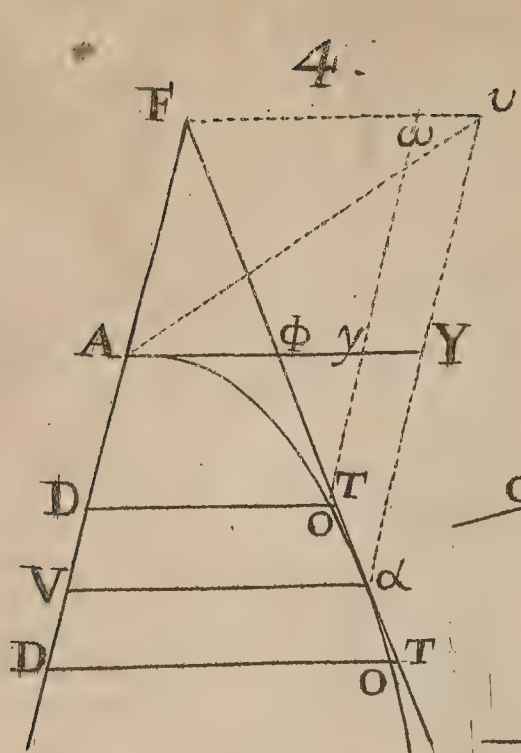


Fig. VII.







Beginning the Eighth Year

PHILOSOPHICAL TRANSACTIONS.

March 25. 1672.

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A Preface to this Eight Year. An Accompt of a New kind of Telescope, invented by Mr. Isaac Newton. A Breviat concerning Dr. Wallis's two Methods of Tangents. A Letter of Monsieur Hevelius about a Comet lately seen by him at Dantzick: confirm'd by Observations made in France. An Accompt concerning Eggs to be found in all sorts of Females. An Accompt of some Books: I. PLANTARUM UMBELLIFERARUM Distributio nova per Tabulas Cognationis & Affinitatis, ex Libro Naturæ observata & detecta; A. Rob. Morison. II. PESTIS nuperæ Londini grassantis Narratio Historica, A. Nath. Hodges. III. A Philosophical Essay, concerning the probable CAUSES of STONES in the Greater world, &c. by D. Thomas Sherley. IV. Carolus Claromontius De AERE, SOLO & AQUIS Angliæ, deque Morbis Anglorum vernaculis; unâ cum ejusdem Observationibus Medicis CAMBRO-BRITANNICIS.

A
P R E F A C E

T O
The Eighth Y E A R.

FOR the Introduction to my Sixth Volume last foregoing, I borrow'd a few lines from our famous Cowley; here I shall make bold to take fuller and warmer encouragements from a Man of far greater renown, and for Learning and Devotion, jointly consider'd, one of the Greatest that hath appear'd in the Christian world these 1200 years and upwards. 'Tis one, that giveth us the old Accompt of the addresses and affectionate respects, which Wise men bore towards Philosophers, and one Philosopher to another; and withall of the travels and perils they undertook by sea and land, over rocks and mountains, and through inhospitable deserts, to visit the most Eminent at the remotest distances, and for the Acquest of Arts and knowledge. The person, I mean, is St. Hierome, and the words, wherein he gives us that relation, are these, *De Saeculi hominibus*;

Legimus in veteribus Historiis quosdam lustrasse provincias, novos adiisse populos, maria transisse, ut eos, quos ex libris noverant, coram quoque viderent. Sic Pythagoras Memphiticos vates; sic Plato Ægyptum & Architam Tarentinum invisit, eamque oram Italiæ, quæ quondam Magna Græcia dicebatur, peragravit; ut qui Athenis Magister erat, & potens, cujusque doctrinam Academia, Gymnasia personabant, fieret peregrinus atque Discipulus; malens aliena verecundè discere, quàm sua imprudenter ingerere: Denique, cum literas quasi toto Orbe fugientes persequitur, captus à Piratis atque venundatus, etiam Tyranno crudelissimo paruit, ductus captivus, vinctus & servus; tamen quia Philosophus, major e mentè se fuit. Ad T. Livium, lacteo eloquentiæ fonte manantem, de ultimis Hispaniæ Galliarumque finibus quosdam venisse Nobiles legimus, & quos ad contemplationem sui

Roma non traxerat, unius hominis fama perduxit; Habuit illa ætas inauditum omnibus sæculis celebrandumque miraculum, ut Urbem tantam ingressi, aliud extraquærerent. Apollonius, sive ille Magus (ut vulgus loquitur) sive Philosophus, ut Pythagorici tradunt, intravit Persas, pertransiit Caucasum, Albanos, Scythas, Massagetas, opulentissima Indiæ regna penetravit, & ad extremum, latissimo Phisonis amne transmissio, pervenit ad Brachmanas, ut Hiarcham, in throno sedentem aureo, & de Tantalii fonte potantem, inter paucos discipulos, de Natura, de Motibus siderum, ac dierum cursu audiret docentem. Inde per Elamytas, Babylonios, Chaldæos, Medos, Assyrios, Parthos, Syros, Phænices, Arabes, Palæstinos, reversus Alexandriam, perrexit in Æthiopiam, ut Gymnosophistas & famosissimam Solis mensam videret in fabulo. Invenit ille Vir ubique quod disceret, & semper proficiens, semper se melior fieret.

So far He; by which lively and flagrant lines we may easily apprehend, what a relish this good Father had for the reputation of Philosophy. And if any do wax pale at the growth of it, they seem to shew thereby, how little they have either of the intelligent Piety of this Holy man, or of the Civility of the Gentile Philosophers.

If it be objected, That here this Learned Father declares a Fondness for Apollonius, as if none but the Vulgar had esteemed him a Magician, but the Pythagoreans claim'd him for a Philosopher; It may be consider'd, that St. Hierome received this indulgent report from the Tradition of the more primitive Fathers, and particularly from Justin Martyr, who doubtless could discern deeper in Philosophy, than Vulgar Heads, and might come nearer to the Truth than Philostratus, who perhaps might affect Romantique Stories. But We have no concernment for Apollonius; only we may vindicate the pious Father for his favourable sentence; since we find it no new thing, that Great Philosophers, Mathematicians and Un-common Artificers should be defamed by the rude multitude for Magicians, or Atheists.

We must grant, that in the last Age, when Operative Philosophy began to recover ground, and to tread on the heels
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of triumphant Philology; emergent adventures and great successes were encountred by dangerous oppositions and strong obstructions: Galilæus and others in Italy suffered extremities for their Celestial Discoveries; and here in England Sr. Walter Raleigh, when he was in his greatest luster, was notoriously slandered, to have erected a School of Atheism, because he gave countenance to Chymistry, to practical Arts, and to curious Mechanical Operations, and design'd to form the best of them into a Colledge. And Queen Elizabeths Gilbert was a long time esteem'd extravagant for his Magnetismes; and Harvey for his diligent researches in pursuance of the Circulation of the Blood.

But, when our renowned Lord Bacon had demonstrated the Methods for a perfect Restauration of all parts of Real knowledge; and the Generous and Philosophical Peyreskius had, soon after, agitated in all parts to redeem the most instructive Antiquities, and to excite Experimental Essays, and fresh Discoveries; The success became on a sudden stupendious, and Effective philosophy began to sparkle, and even to flow into beams of bright-shining Light, all over the World. And the said Peyreskius his Orators, Gassendus and Bucchardus, have in their Histories and Panegyricks raised him a more splendid Monument, than some of the greatest Monarchs can shew. And it is remarkable, that when Bucchardus, a very eloquent Frenchman, had at Rome, in Academia Humoristarum, extolled, in a Funeral Oration, this his Countryman Peyreskius for one of the most wonderful Advancers of all kinds of Literature and of Arts that any age or place brought forth; yet he came off with universal applause, and devout acclamations, though Pope Urban the 8th, and his favourite Cardinals, and several great Princes in Italy, and many excellent persons in Rome, did then highly pretend, and might not unjustly lay claim to the patronage, and extraordinary merit in every kind of Learning, Art, and Elegancy.

These Vertues will shine brightest amongst the Vertuous; and although the Emulation of Countries may grow hot, yet the beauty of Vertue, and the truth of Philosophy will prevail. The East and the Brachmans had the old Fame, (as the learned Father

Father hath told us above,) but the Curious Monsieur Bernier being lately returned from the Mogolians, gives us good assurance, that neither they, nor their Brachmans, are now worthy to teach the Europeans; but the Wisest amongst them do rejoyce in the philosophical Light, which now shines in the West, and in our North. And who knows, how soon or how potently our wonderful progress of Arts, and the Lustre of our Philosophy may awaken them, to embrace the more glorious doctrine of the Gospel. We hope, this Ingenious Travellour will make hast to give us a Philosophical accompt of his Travels, with no less accurateness, than he hath given us the Political Mysteries of the Mogolians, and the Sottishness of the Christian Abyssins or Æthiopians.

When the Emulation was hottest on both sides the Alpes, who should excell in the flowry Arts of Oratory and Poetry, though Sanazary was then on one side of the Alpes, and far greater men, great Poets on the other side in France; yet both the Scalligers, Julius and Josephus, themselves Italians and French, gave the lawrel to Buchanan a Scot. And thus the West or Northwind, bringing the sweet flowers of Philology, and the richest fruit of Philosophy, will be more wellcome to the Intelligent, than the fetid and contagious blasts from the East. And the Wise and the Vertuous ought not to regard the Censures and reproaches of the ignorant or malignant Multitudes. They retain an internal satisfaction within themselves; and sound Philosophers are mutually each to other sufficient Theaters. I shall no longer detain the Curious and Ingenious Reader from the business we have in hand.

An Accompt

An Account of a New Catadioptrical Telescope invented by Mr. Newton, Fellow of the R. Society, and Professor of the Mathematicques in the University of Cambridge.

THis Excellent Mathematician having given us, in the Transactions of *February* last, an account of the cause, which induced him to think upon *Reflecting* Telescopes, instead of *Refracting* ones, hath thereupon presented the Curious World with an *Essay* of what may be performed by such Telescopes; by which it is found, that Telescopical Tubes may be considerably shortned without prejudice to their magnifying effect.

This new instrument is composed of two Metallin *speculum's*, the one Concave, (instead of an Object-glass) the other Plain; and also of a small plano-convex Eye-Glass.

By *Figure I.* of *Tab. I.* the structure of it may be easily imagined; viz. *That* the Tube of this Telescope is open at the end which respects the object; *that* the other end is close, where the said Concave is laid, and *that* near the open end there is a flat oval *speculum*, made as small as may be, the less to obstruct the entrance of the rays of Light, and inclined towards the upper part of the Tube, where is a little hole furnish't with the said Eye-glass. So that the rays coming from the object, do first fall on the Concave placed at the bottom of the Tube; and are thence reflected toward the other end of it, where they meet with the flat *speculum*, obliquity posited, by the reflection of which they are directed to the little plano-convex Glass, and so to the Spectators Eye, who looking downwards sees the Object, which the Telescope is turned to.

To understand this more distinctly and fully, the Reader may please to look upon the said *Figure*, in which

AB is the Concave *speculum*, of which the *radius* or semi-diameter is $12\frac{2}{3}$ or 13 inches.

CD another metalline *speculum*, whole surface is flat, and the circumference oval.

CD an Iron wire, holding a ring of brass, in which the *speculum CD* is fixed.

F, a small Eye-glass flat above, and convex below, of the twelfth part of an inch *radius*, if not less; forasmuch as the metal collects the Sun's rays at $6\frac{1}{3}$ inches distance, and the Eye-glass at less than $\frac{1}{2}$ of an inch distance from its vertex: Besides that the Author (as he informs us) knew their dimensions by the tools to which they were ground, and particularly measuring the diameter of the hemi-spherical Concave, in which the Eye-glass was wrought, found it the *sixth* part of an inch.

GGG, the fore part of the Tube fastn'd to a brass-ring *HI*, to keep it immoveable.

PQL, the hind-part of the Tube, fastn'd to another brass-ring *PQ*.

O, an Iron hook fastn'd to the Ring *PQ*, and furnish'd with a screw *N*, thereby to advance or draw back the hind-part of the Tube, and so by that means to put the *specula* in their due distance.

MQL a crooked Iron sustaining the Tube, and fastned by the nail *R* to the Ball and Socket *S*, whereby the Tube may be turned every way.

The Center of the flat *speculum CD*, must be placed in the same point of the Tube's Axe, where falls the perpendicular to this Axe, drawn to the same from the center of the little Eye-glass: which point is here marked at *T*.

And to give the Reader some satisfaction to understand, in what degree it represents things distinct, and free from colours, and to know the aperture by which it admits light: he may compare the distances of the *focus E* from the *vertex's* of the little Eye-glass and the Concave *speculum*, that is, *EF*, $\frac{1}{2}$ of an inch, and *ETV*, $6\frac{1}{3}$ inches; and the *ratio* will be found as 1 to 38; whereby it appears, that the Objects will be magnified about 38 times. To which proportion is very consentaneous, an Observation of the Crown on the weather-cock, about 300 feet distant. For the scheme *X* fig. 2., represents it bigger by $2\frac{1}{2}$ times in diameter, when seen through

through this, than through an ordinary Telescope of about 2 foot long. And so supposing this ordinary one to magnifie 13 or 14 times, as by the description it should, this new one by the Experiment must magnifie near as much as hath been assigned.

Thus far as to the structure of this Telescope. Concerning the Metalline matter, fit for these reflecting *Speculums*, the Inventor hath also considered the same, as may be seen by two of his Letters, written to the Publisher from Cambridge Jan. 18. and 29. 16⁷¹/₇₂. to this effect, *viz.*

1. That for a fit metalline substance, he would give this Caution, that whilest men seek for a white, hard and durable metallin composition, they resolve not upon such an one, as is full of small pores, only discoverable by a Microscope. For though such an one may to appearance take a good polish, yet the edges of those small pores will wear away faster in the polishing than the other parts of the metal; and so, however the Metal seem polite, yet it shall not reflect with such an accurate regularity as it ought to do. Thus Tin-glass mixt with ordinary Bell-metall makes it more white and apt to reflect a greater quantity of light; but withall its fumes, raised in the fusion, like so many aerial bubbles, fill the metall full of those Microscopical pores. But white Arsenick both blanches the Metall and leaves it solid without any such pores, especially if the fusion hath not been too violent. What the *Stellate Regular* of Mars (which I have sometimes used) or other such like substance will do, deserves particular examination.

To this he adds this further intimation, that *Putty* or other such like powder, with which 'tis polished, by the sharp angles of its particles fretteth the metall, if it be not very fine, and fills it full of such small holes, as he speaketh of. Wherefore care must be taken of that, before judgment be given, whether the metall be throughout the body of it porous or not.

2. He not having tried, as he saith, many proportions of the Arsenick and Metall, does not affirm, which is absolutely best, but thinks, there may conveniently be used

any



any quantity of Arsenick equalling in weight between a sixt and eight part of the Copper, a greater proportion making the Metal brittle.

The way, which he used, was this. He first melted the Copper alone, then put in the Arsenick, which being melted, he stirred them a little together, bewaring in the mean time, not to draw in breath near the pernicious fumes. After this, he put in Tin, and again so soon as that was melted (which was very suddenly) he stirred them well together, and immediately poured them off.

He saith, he knows not, whether by letting them stand longer on the fire after the Tin was melted, a higher degree of fusion would have made the metall porous; but he thought that way he proceeded to be safest.

He adds, that in that metall, which he sent to *London*, there was no Arsenick, but a small proportion of Silver; as he remembers, one shilling in three ounces of metall. But he thought withall, that the Silver did as much harm in making the metall soft, and so less fit to be polish't, as good in rendring it white and luminous.

At another time he mixed Arsenick one ounce, Copper six ounces, and Tin two ounces: And this an Acquaintance of his hath, as he intimates, polish't better, than he did the other.

As to the *objection*, that with this kind of Perspectives, objects are difficultly found, he answers in another letter of his to the Publisher, of Jan. 6. 16⁷¹/₇₂. that that is the inconvenience of all Tubes that magnifie much; and that after a little use the inconvenience will grow less, seeing that himself could readily enough find any day-Objects, by knowing which way they were posited from other objects that he accidentally saw in it; but in the night to find Stars, he acknowledges it to be more troublesome; which yet may, in his opinion, be easily remedied by two sights affixed to the Iron rod, by which the Tube is susteined; or by an ordinary perspective glass fastn'd to the same frame with the Tube, and directed towards the same object, as *Des-Cartes* in his *Dioptricks* hath described for remedying the same inconvenience of his best Telescopes.

So far the Inventors Letters touching this Instrument : of which having communicated the description to Monsieur Christian Hugen de Zulichem, we received from him an Answer to this effect, in his Letter of Febr. 13. 1672. st.n.

I see by the Description, you have sent me of Mr. Newtons admirable Telescope, that he hath well considered the advantage, which a *Concave speculum* hath above *Convex glasses* in collecting the parallel rays, which certainly according to the calculation, I have made thereof, is very great. Hence it is, that he can give a far greater aperture to that *speculum*, than to an Object-glass of the same distance of the *focus*, and consequently that he can much more magnifie objects this way, than by an ordinary Telescope. Besides, by it he avoids an inconvenience, which is inseparable from convex Object-Glasses, which is the Obliquity of both their surfaces, which vitiateth the refraction of the rays that pass towards the sides of the glass, and does more hurt than men are aware of. Again, by the meer reflection of the metallin *speculum* there are not so many rays lost, as in Glasses, which reflect a considerable quantity by each of their surfaces, and besides intercept many of them by the obscurity of their matter.

Mean time, the main business will be, to find a matter for this *speculum* that will bear so good and even a polish as Glasses, and a way of giving this polish without vitiating the spherical figure. Hitherto I have found no *Specula*, that had near so good a polish as Glass; and if M. Newton hath not already found a way to make it better, than ordinarily Paperphend, his Telescopes will not so well distinguish objects, as those with Glasses. But 'tis worth while to search for a remedy to this inconvenience, and I despair not of finding one. I believe, that M. Newton hath not been without considering the advantage, which a *Parabolical speculum* would have above a *Spherical* one in this construction; but that he despairs, as well as I do, of working other surfaces than spherical ones with due exactness; though else it be more easie to make a *Parabolical* than *Elliptical* or *Hyperbolical* ones, by reason of a certain propriety of the *Parabolick Conoid*, which

is, that all the Sections parallel to the Axis make the same Parabola.

Thus far M. *Hugenius* his judicious Letter; to the latter part of which, concerning the grinding *Parabolical Conoids*, Mr. *Newton* saith, in his Letter to the Publisher of Feb. 20. 71. that though he with him despairs of performing that work by Geometrical rules, yet he doubts not but that the thing may in some measure be accomplished by Mechanical devices.

To all which I cannot but subjoyn an Extract of a Letter, received very lately, (March 19th) from the Inventor of this new Telescope, from Cambridge, viz.

IN my last Letter I gave you occasion to suspect, that the Instrument which I sent you, is in some respect or other indisposed, or that the metals are tarnished. And by your Letter of March 16. I am fully confirmed in that opinion. For, whilst I had it, it represented the Moon in some parts of it as distinctly, as other Telescopes usually do which magnifie as much as that. Yet I very well know, that that Instrument hath its imperfections both in the composition of the metall, and in its being badly cast, as you may perceive by a scabrous place near the middle of the metall of it on the polished side, and also in the figure of that metall near that scabrous place. And in all those respects that instrument is capable of further improvement.

You seem to intimate, that the proportion of 38 to 1 holds only for its magnifying Objects at small distances. But if for such distances, suppose 500 feet, it magnifie at that rate, by the rules of Opticks it must for the greatest distance imaginable magnifie more than $37\frac{3}{4}$ to 1; which is so considerable a diminishing, that it may be even then as 38 to 1.

Here is made another Instrument like the former, which does very well. Yesterday I compared it with a six foot Telescope, and found it not only to magnifie more, but also more distinctly. And to day I found, that I could read in one of the *Philosophical Transactions*, placed in the Sun's light,

light, at an hundred foot distance, and that at an hundred and twenty foot distance I could discern some of the words. When I made this tryal, its Aperture (defined next the Eye) was equivalent to more than an inch and a third part of the Object-metall. This may be of some use to those that shall endeavour any thing in *Reflexions*; for hereby they will in some measure be enabled to judge of the goodness of their Instruments, &c.

N. B. The Reader may expect in the next *Month* another Letter, which came somewhat too late to be here inserted; containing a *Table*, calculated by the same Mr. *Newton*, about the several *Apertures* and *Charges* answering the several *Lengths* of these Telescopes.

E P I T O M E

Binæ Methodi Tangentium Doctoris *Johannis Wallisii* Geom. Prof. Saviliani Oxoniæ; aliàs fufius & explicatius ab ipso traditæ, hîc verò ob angustiam loci compendifactæ: In quarum Schematîsmis si forsan literæ quædam redundaverint, illæ ad ea pertinere censendæ sunt, quæ in ampliori ejusdem Scripto continentur, hîc vero dictâ de causa omitantur.

H Abes hic (Clarissime vir) eorum summam (strictim traditam) quæ fufius scripseram, meas de Tangentibus Methodos spectantia; duas potissimum quibus præsertim utor; alteram in Speciebus, alteram in Lineis; utramque generali formâ faciliè explicabilem.

Priorem adhibeo Con. Sect. prop. 23, 30, 36, 46, 49. & passim alibi. Quæ hæc est.

Expositâ Curvâ *Aa*, (putâ Parabola, fig. 4.) quam in *a* tangat *a-F*, diametro *VDA* occurrens in *F*; ordinatim applicentur *aV*, & *DOT* curvæ in *O* & tangenti in *T* occurrens. Ponatur autem *Va=b*, *VA=v*, *VF=f*, *VD=a*, adeoque *DA=v+a*, *DF=f+a*:

Est (propter similia triangula) $VF.DF :: Va.DT = \frac{f+a}{f}b$.

Item, si tangens sit ultra curvam, $DT > DO$; si citra, $DT < DO$: Nempe, $DT=DO$ si intelligatur *D* in *V*; sed, si extra *V*, *DT* vel *DO* major prout tangens est ultra citrave curvam.

Tum,

Tum, habita ipsius DO designatione quæ sit expositæ curvæ accommodata; (puta, in Parabola, propter $AV. AD :: Vaq. DOq = \frac{v \pm a}{v} b^2$; $DO = b\sqrt{\frac{v \pm a}{v}}$;) fiat debita reduciō, (puta, propter $\frac{f \pm a}{f} b \geq b\sqrt{\frac{v \pm a}{a}}$, adeoque $\frac{f^2 \pm 2fa + a^2}{f^2} \geq \frac{v \pm a}{v}$, & $f^2 v \pm 2fva + va^2 \geq f^2 v \pm f^2 a$; deletis utrinque æqualibus, hoc est, iis omnibus in quibus a non conspicitur; cæterisque per $\pm a$ divisiss: $2fv \pm va \geq f^2$.)

Tandem (qui methodi nucleus est) posito D in V , (quò sit $a=0$, adeoque evanescent ipsius multipla omnia,) æquatio exhibebit f. quæsitam (puta $2fv \pm va = 2fv = f^2$, adeoque $2v = f$.)

Hanc (locis citatis) accommodatam videas Parabolæ, Ellipsi, Circulove, Hyperbolæ, Paraboloidibus omnibus, (quibus & harum Reciprocas accenseo,) atque alibi aliis.

Cissoïdi (fig. 5.) sic accommodes. Est (per cap. 5. pr. 29. de Motu) $Va = b = \frac{v^2}{s = v h}$, (posito s pro sinu recto in circulo generante, cujus radius r , sinus versus v , & $2r - v = h$, & $h - v = 2x$,) adeoque (substitutis $v \pm a$ pro v , & $h \mp a$ pro h ,) $\frac{v^2 \pm 2va + a^2}{v:vh \pm 2xa - a^2}$ ($= DO \geq$ ($DT = \frac{f \pm a}{f} b =$) $\frac{f \pm a}{f} \times \frac{v^2}{v h}$. Ergo (sumptis quadratis, & multiplicando decussatim,) $f^2 v^5 h + 6f^2 v^3 h a^2 + f^2 v h a^4 \pm 4f^2 v^4 h a \pm 4f^2 v^2 h a^3 \geq f^2 v^5 h \pm 2f v^5 h a + v^5 h a^2 \pm 2f^2 v^4 x a + 4f v^4 x a^2 \pm 2v^4 x a^3 - f^2 v^4 a^2 \mp 2f v^4 a^3 - v^4 a^4$: item (deletis utrinque æqualibus, cæterisque per $\pm v a$ divisiss) $\pm 6f^2 v^2 h a \pm f^2 h a^3 + 4f^2 v^3 h + 4f^2 v h a^2 \geq 2f v^4 h \pm v^4 h a + 2f^2 v^3 x \pm 4f v^3 x a \pm 2v^3 x a^2 \mp f^2 v^3 a - 2f v^3 a^2 \mp v^3 a^3$. Denique (posito D in V , quo evanescat a cum suis multiplis, cæterisque per $f v^3$ divisiss) fiet æquatio $2fh - fx = v h$, adeoque $\frac{v h = 5^2}{2h - x = r + h = 3r - v} = f$.

Idem succedet, sumptâ, pro VA , diametro TA , (cui tangens occurrat in Φ) aliâ VC . Item, si exponeretur curva quæ ordinatas non habeat, sed quæ his equipolleant; ut sunt, in Spirali, crescentes radii.

Sed & calculi magna pars præverti potest; omissis ab initio (utpote post reiiciendis) terminis iis ubi habetur a^2 vel superior hujus potestas; item iis in quibus nec a conspicitur, nec sunt in a ducendi, (utpote æqualibus utrinque prodituris.) Exempli gratiâ.

In Conchoide, (fig 6.) *cujus ordinata VMa constat ex sinu recto*
 $VM=s=\sqrt{vh}$, & tangente $Ma=CH=\frac{s}{x}r$, (si sit $CP=CA=r$,
adeoque $CH=AS$;) saltem $=\frac{s}{x}p$ (posito $CP=s$;) adeoque $Va=b$
 $=s+\frac{s}{x}r=\frac{x+r}{x}s=\frac{h}{x}s$, saltem $\frac{x+p}{x}s=\frac{n}{x}s=\frac{n}{x}\sqrt{vh}$ (posito $x+p=n$.)
Ergo $DT=\frac{f+a}{a}b=\frac{f+a}{fx}n\sqrt{vh}\geq DO=\frac{n+a}{n+a}\sqrt{vh+2xa}=:$ (omitto
 a^2 , quia post delendum, indeque oriunda, & sic semper:) & sum-
tis quadratis, $\frac{f^2+2fa+a^2}{f^2x^2}n^2vh\geq\frac{n^2vh+2n^2xa+2nvh+a^2}{x^2+2xa-}$ (hoc est, \geq su-
pra, sed \leq infra, punctum flexus contrarii.) Et, decussatim multi-
plicando; omissis (ut præcipitur) $f^2x^2n^2vh$ utrobique, omnibus-
que a^2 multiplis; cæterosque per $\pm a$ divisiss; $2fn^2vhn^2-2f^2$
 $n^2vhn\pm\geq 2f^2n^2x^3-2f^2nvhn^2$: adeoque (posito D in V ,)
 $nvhr=fnvh+fnx^2-fvhn=fnr^2-fvhn$ (propter $vh+$
 $x^2=s^2+x^2=r^2$;) & $f=\frac{vh=s^2}{nr^2-vha}nx$. Et quidem, in prima-
ria, (propter $h=n$;) $f=\frac{s^2x}{r^2-x^2}$.

In Figura Tangentium (fig. 7.) quæ à Conchoide differt, ex-
empto quadrante genitore; idem erit processus, nisi quod, propter
 $Va=Ma=\frac{p}{x}s$ (non $\frac{n}{x}s$;) prodibit (sive in primaria, sive in pro-
tracta contractave,) $f=\frac{vh=s^2}{r^2}x$.

In Figura Secantium (fig. 8.) propter $Va=b=\frac{r^2}{x}$; erit
 $DO=\frac{r^2}{x+a}\geq\frac{f+a}{fx}r^2=DT$. adeoque $f=x$.

Cumque hæc curva sit Hyberbola (per pr. 30. cap. 5. & pr. 1. cap.
15. de Motu,) *cujus Asymptotæ CA, CB: eadem tangens habetur*
per pr. 36. Con. sect. Cumque ordinatæ ad asymptotas (per pr.
94, 95, Arith. Infin.) sint series Reciproca Primanorum
(quæ ad Paraboloidium genus spectat, verticem habens C, exponen-
tem -1 ,) habetur eadem tangens per prop. 49. Con. Sect. (eadem-
que est expedita methodus pro hyperbolæ cujuscvis tangente per asym-
ptotam inveniendâ.) Quippe, in Paraboloidibus omnibus, ut in-
tercepta diameter VC, ad VF, sic 1 ad exponentem: hoc est, in præ-
senti casu, ut 1 ad -1 ; adeoque $VC=VF$, sed (propter contraria
signa $+$ $-$) ad contrarias partes.

Notandum hic; in Parabolâ, Paraboloidè, Hyperbolâ, Ellipsi,
&c. figurâve Sinuum (rectorum, versorumve,) Arcuum, Tan-
gentium,

gentium, Secantium, &c. aliâve cujus constructio est Similaris; protractio contractiove figuræ (seu mutatio Lateris recti, aut quod hujus instar est,) non mutat punctum F , (eo quod Latus-rectum æquationem quæ longitudinem VF determinat non ingrediatur, utut eam ingrediatur quæ determinat longitudinem Va , mutetque angulos ad a & F ;) sed ubi constructio est Dissimilaris, ut in Cycloïde & Conchoïde (propter ordinatam illic ex Sinu & Arcu, hîc ex Sinu & Tangente, conflata,) aliisque istiusmodi, res secus est: eò quod una pars (ut Arcus in Cycloïde & Tangens in Conchoïde) protrahitur contrahiturve, manente altera (puta, in utrisque Sinu recto) ut in primariâ.

Idemque dicendum de Angulo applicationis (ad V ,) cujus mutatio non mutat longitudinem VF , sed neque Va , quia neutrius ingreditur æquationem. Atque hinc fit, quod in figura Scalena, quæ ordinatas contrarias, utrinque ad V positas, spectant tangentes, utut inæquales, in eodem F conveniant. Sed & (ut hoc obiter moneam) quadratorum aggregatum habent idem atque in erectâ; nempe semper $= 2Va q + 2VF q$.

Estque hæc mihi methodus pro Maximis & Minimis in omne genus quantitatibus.

Methodus altera (secundum tradita de Angulo Contactus & Arithm. Infin.) curvam considerat tanquam ex particulis conflata infinitè exiguis, sed certam positionem habentibus; eandem nempe (propter contactûs angulum sive nullius magnitudinis sive infinitè exiguae) cum recta ibidem tangente: adeoque cum hac (respectu cujusvis rectæ) pariter declivem, (ut est Montis Aa fig. 4, 5, declivitas in a , eadem quæ tangentis aF .) Cujus ergo quæque particula (per cap. 2. de Motu) est in eâ ratione magis longa (quàm est respectiva expositæ rectæ particula æquè-alta) quàm est minus declivis; puta aT quàm VD : Unde, propter mutatam in singulis punctis declivitatem, oritur series longitudinum inæqualium in curvâ, seriei æqualium in rectâ, respondens; curvæ ad rectam rationem exhibens. Atque hinc methodus mea pro curvis rectificandis, (schol. prop. 38. Ar. Infin. insinuata,) quam prosequor tractatu de Euclid, item de motu cap. 5. prop. 13. & seqq. Cujus aliqua pars est hæc de Tangentibus, ut quæ non totam declivitatum seriem perpendit, sed eam quæ est in exposito puncto.

Hanc respectivam particularum longitudinem, aliàs insinuatam
erant.

eunt (motu forinsecus assumpto) per motuum quibus transigantur $\iota\omicron\chi\epsilon\omicron\upsilon\upsilon$ celeritatem. (Quippe idem est, in Motu, Celeritas, atque hæc, in Situ (propter positionem obliquam seu minus declivem) respectiva Longitudo.) Aptissimè quidem in lineis à motu primitus oriundis, (putà, Cycloide, Conchoide, spirali, Quadra- trice, &c.) nec ineptè in aliis, quæ fingi saltem possunt istiusmodi motibus describi.

Præsumo autem (ex prop. 15. cap. 2. de Motu) eam esse curvæ in quovis puncto directionem, adeoque & declivitatem, quæ est rectæ ibidem tangentis: Item (ex prop. 6. cap. 10.) Motus compositi di- rectionem esse in Diagonio parallelogrammi, cujus latera & anguli exhibeant componentium celeritates & directiones.

Intelligatur jam (fig. 4.) Aa parabola, describi motu composito, ex æquabili secundum AY vel Va , cujus itaque particulae $\iota\omicron\chi\epsilon\omicron\upsilon\upsilon$ (per pr. 3. cap. 10. de Motu) sunt series Primariorum, quæ ad se- riem totidem ultimæ æqualium, (hoc est, ad rectam $\iota\omicron\chi\epsilon\omicron\upsilon\upsilon$ celeri- tate in a acquisitâ transigendam,) est ut 1 ad 2, (per Ar. Infin. pr. 64. vel pr. 1. cap. 5. de Motu.) Adeoque, sumpta $VF = 2VA$, & composito EVa parallelogrammo; juncta aF est Tan- gens.

Idem similiter obtinebitur in Paraboloidibus quibuscunque, ope prop. 2, 5, 6, 7, de Motu.

Atque inde facile (vel ex iisdem principiis) ostenditur; si intel- ligatur Fig. AY sic constituta, ut momenta (respectu AF) ordi- natorum Yv , $y\omega$, sint ipsis Ya , yO , ordinatis proportionalia; e- runt Celeritates acquisitæ in a , ω , seu V , D , (positâ AY linea mo- tûs æqualis) rectis Ya , $y\omega$, proportionales: Et consequenter, ut AvY (illarum aggregatum) ad $AFvY$ (aggregatum totidem maxi- mæ æqualium,) sic VA (aggregatum celeritatum seu particularum crescentium) ad (aggregatum totidem maximæ æqualium) TF .

Spiralis ASa (fig. 9.) punctum a designatur motu composito ex recto per Aa , & circulari per Va , æquabilibus utrisque & $\iota\omicron\chi\epsilon\omicron\upsilon\upsilon$. Ergo, sumpta circuli tangente $\omega = aV$, & completo $A\omega F$ paralle- logrammo; juncta aF Spiralem tanget.

Unde statim emergit Archimedeæ quadratura (sive Circuli sive Sectoris cujusvis) propter $AF = \omega = aV$.

Sin motuum alter, puta Aa , sit acceleratus vel retardatus; pro

aA , sumenda erit aB (in ea ad illuminationem quam illa postulat acceleratione seu retardatio,) eritque diagonum $a\beta$, Tangens quaesita.

Quadratricis AaB (fig. 10.) punctum a designatur motu composito ex recto per va , & circulari in Ya (aequalibus & incommensurabilibus.) Ergo, sumpta tangente $aV = aY$, & completo parallelogrammo $VaaF$, juncta aF tanget Quadratricem.

Atque hinc alia quadratura, per Tangentem quadratricis, propter $vF = aV = aY$.

Illa per quadratricis Basin, sic elicitur. Positis $CA = r$, $AQ = q$, $YZ = x$, $QR = a$. Erit (propter Quadratricis constructionem) $AQ : RQ :: AC$. $AE = \frac{2}{3}r :: YZ$, $aZ = \frac{2}{3}x$. Estque $aZ > aE$ sumpto ubivis in AB puncto a , praeterquam in B , quo casu (evanescente utraque) erit $aZ = aE$, adeoque $x = r$; hoc est, $YZ = XB = AC$. Sed & vE communis tangens utrique curvae XB , AB .

Cycloidis (fig. 11.) punctum a describitur motu composito, ex recto in aV , & circulari in $a\beta$ (aequalibus & aequè velocibus.) Ergo, sumpta tangente $av = aV$, & completo $VaaF$ parallelogrammo, juncta aF Cycloidem tanget. Et quidem, propter Ang. $vaF (= a\beta F = \frac{1}{2}aCF) = \frac{1}{2}vaV$, occurret circuli $a\beta$ erectae diametro in vertice.

In secundariis (contracta protractave) sumenda erit av ad aV , in ea ratione major minerve, quàm est celeritas motus circularis ad celeritatem recti.

In Figura Arcuum, Sinuumve, (fig. 12.) procedendum ut in Cycloide, nisi quòd (propter exemptum semicirculum genitorem) pro tangente av illic (quae hic est at) sumenda erit erecta av aequæ alta.

Conchoidis (fig. 6.) punctum a designatur motu composito, ex aequali circulari in $a\beta$ (hujusve tangente av) & recto in aY accelerato pro incremento tangentium: quae quidem acceleratio duplex est, altera propter declivitatis angulum βaY , hoc est, vaY , continuè crescentem; altera propter radii in secantem protractionem, continuè item crescentem. Propter priorem, ducta tangente av (quae occurrat in v regulae CH), recta vZ (parallela rectae PHa), occurrat aY in Z : Propter posteriorem; eadem vZ protracta occurrat tangenti verticis in Z : indeque ZY rectae vaX parallela; adeoque $aY = XZ$.

$af :: CM. MS :: P\mu. PH.$ Completo denique $Tavf$ parallelogrammo, juncta af tanget concheidem.

In secundariis (ubi non est $CP=CA$.) sumenda erit aT ad jam designatam, ut est CP ad CA .

In Figura Tangentium (fig. 7.) propter exemptum Conchoidi quadrantem genitorem, pro tangente av illis (quæ hîc est at) sumenda erit erecta av æquè-alta.

Pluribus exemplis proferendis supersedeo. Moneo tamen, utramvis Methodum, utut tangentibus rectis hîc accommodatam, extendi posse ad mutuum Curvarum tactum. Puta; si, pro FVa triangulo (fig. 4, 5.) intelligatur Hyperbola; recta DT , quæ hîc insignitur characterem qui triangulo conveniet, subire tum debet characterem Hyperboles; cujus vertex F simili processu quæritur. Similisque in posteriori methodo accommodatus est linearum ductus. Et quidem, cum curvam Aa tangens recta aF , sit etiam tangens communis curvarum omnium, expositam ibidem tangentium; prout hîc, ex data Aa curva quæritur recta aF , sic ex hac datâ (per eandem methodum inversam) quærenda erit alia tangens curva, modò satis sit determinata.

Sed ampliandum non est. Tu itaque Vale.

Tuus

Oxoniz die 15.

Febr. 1671.

Johannes Wallis.

Extratt

Extract of a Letter of Monsieur Hevelius from Dantzick written to the Publisher in Latin, March 9. (st. nov.) 1672; giving some Account of a New Comet, lately seen in that Country: Englished as followeth.

I Shall not excuse my long silence, but acquaint you in brief with a New Appearance in the Heavens. There hath been seen here a *New Comet* from the 2^d of March 1672; which I my self, being some daies absent from home and from my instruments, could not observe till March 6th in the evening. It is seen both mornings and evenings. It is but little, having at the present a train not above a degree or a degree and an half long: which would doubtless appear bigger, if it were not for the twy-light, and the Moon were absent. It is now about the Stars in the right Arm of *Andromeda* on her Shoulder-blade. As far as I can collect from one or two observations, it tends towards the *Lucida* of *Andromeda's* girdle, and that with a direct diurnal motion of about two degrees in its course. See Fig. 13. Tab.

The 6th of March in the evening, h. 7. 40'. it was in grad^u 7. of γ in the 35th deg. of Northern Latitude; as I guessed by the hasty inspection of a Globe.

March 7. in the morning h. 3. 30'. its Longitude was about 8. deg. γ , with a somewhat lesser latitude than before: in the Evening of the same day its Longitude was 10. deg. γ , and Latitude 34. deg. *ferè*.

March 8. in the morning h. 4. the Longitude was 12. deg. γ . and the Latitude 33. deg: Which yet I would not have taken precisely, because I cannot yet reduce my Observations to a *calculus*. This evening, I hope, I shall see him again; although this morning we could see nothing by reason of the dark weather.

I intend to send you by the next more particular and more accurate Observations, which I purpose to make carefully, as oft as I can, with my Brass Octant, which is about 9 feet long. And I long to hear, what you or other Nations have observed of this Phenomenon.

M m m m 2

Besides,

Besides, I cannot but advertise you, that I have observed again March 6. 1672. the New Star under the Head of the Constellation of the *Swan*; but it can hardly be seen as yet with the naked Eye.

So far this diligent Observer; with whose Observations we presently acquainted some of our Astronomers here, to excite them to make theirs also in this place; who yet have seen nothing of this Comet hitherto.

Mean time we have received fresh Letters from *Paris*, informing us, that there, and at *La Fleche* also, it hath been seen, from *March 16* (st. n.) untill *March 26*; both inclusively: Of which we expect a particular account hereafter. At the present they intimate, that the reason why it hath not been observed but very late, is, that for a good while it was near the Sun; and when it was got clear of him, it was much obscured by the Moon.

Since this, we have been informed by our Worthy and Learned Friend Mr. *Isaac Newton*, that about the 16th of *March 16th*, st. v. he saw at night a dull Star South-west of *Persus*, which, he saith, he now takes to have been that Comet, of which we gave him information: But he adds, that it was very small, and had not any visible Tail, which made him regard it no further; he fearing withall, that it will now be difficult to find it.

An Account of what hath been of late observed by Dr. Kerkringius concerning Eggs to be found in all sorts of Females.

ALTHOUGH we have already (N^o. 70.) taken notice in brief of what the Inquisitive *Kerkringius* hath discoursed of, concerning *Ovaria* and *Ova* in all sorts of Femals; yet, to excite the more vigorously our eminent Anatomists here to a further search into this matter, as those of that profession in many forrain parts, as *France, Italy, Holland, &c.* employ themselves to find what truth there is in it; we thought, it would not be unwelcome to the Curious of all sorts of this Country, to give them here in *English* a particular description of what the said *Kerkringius* hath from his own Observations delivered

delivered on this subject: In the doing of which we shall not scruple to follow the French Philosophical Journals, published March 15. 21. and 22, to this effect;

What Doctor *Kerkring*, (saith one of them) hath from his curious Observations advanced, viz. That Man hath his origin from an Egg, hath been very differently received, some appearing surpris'd at it, others rallying with it, and many being induced thereby to make further inquiry into it. This great diversity of sentiments made me think, I should do well for the satisfaction of all sorts of people, to insert here the particulars themselves, observed by the said Dr. *Kerkring*, and to add hereafter some Reflections, that may seem necessary to remove the principal difficulties occurring in this matter.

But since the things to be said do suppose some knowledge of the Parts, where these Eggs are formed and perfected, it will not be amiss, beforehand to cast your Eyes upon the *Figures* of Table II, of which the 1st represents a *Matrix* with its chief dependances: where

B. is the *Matrix*.

C. the *Bladder of Urine*, fastned to the neck of the *matrix*.

D.D. the two *testiculi*, or rather the repository's, which contain the Eggs spoken of.

E.E. the two *Tubes* of the *matrix*.

F.F. the two *vasa deferentia*, esteemed by *Anatomists* to convey semen testiculorum in uterum.

G. G. the two *vasa præparantia*, for preparing the matter, to be perfected in testiculis.

Fig. II. represents Eggs of different bigness, as Dr. *Kerkring* affirms to have found them in the testicles of a Woman.

Fig. III. shews a bigger Egg, such an one as we have found at *Paris* in a Woman of 40 years of age, and in those of a Maid of 18 years.

Fig. IV. exhibits smaller Eggs, of which we have found a good number in the testicles of a Cow.

Fig. V. represents an Egg, which Dr. *Kerkring* affirms to have opened three or four days after it was fallen into the *matrix* of a Woman, and in which he saw that little *embryon* marked *B*, whereof he found the Head begun to be distinguished from the

the Body yet without a distinct preception of the organs.

Fig. VI. shews a bigger Egg, which *D. Kerkring* did open a fortnight after conception, finding in it these particulars ;

<i>A.</i> a little <i>Secondine</i> .	<i>D.</i> the Navel-string, by which the
<i>B. B. B. B.</i> the membrane, <i>Co-</i>	Child is fastned to the <i>Secondine</i> .
<i>rion</i> , divided in four places.	<i>E.</i> a Child of 14 days after Concep-
<i>C. C. C. C.</i> the membrane, <i>Am-</i>	tion, in which the face begins to appear,
<i>nios</i> , divided so too.	together with the principal parts of the
	Body.

Fig. VII. represents the *Skeleton* of an Infant, found by the same in one of these Eggs three weeks after Conception.

Fig. VIII. exhibits the *Skeleton* of an other Child, found also by him in an Egg, a moneth after Conception.

Fig. IX. represents the *Skeleton* of an *Embryon*, found by him in an Egg six weeks after Conception.

Though this Opinion (*saieth Kerkringius*) about the first formation of Man in an Egg, as that of all Fowl, is not common, yet 'tis true ; and if any find it difficult to believe, he may cast his Eyes upon *Fig. II.* where he will see of those Eggs represented after the life, as I have found them my self in the body of many Women open'd by me.

These Eggs are to be met with, not only in the testicles of Women married, but also in those of Maids, even as young Hens will lay Eggs without any commerce with a Cock.

These Eggs are of the bigness of a pea, and they contain a glutinous liquor, which will be hardn'd by the fire, just as the White and Yolk in other Eggs. The tast of them is flat and unpleasant enough ; they are invested with one or two fine skins, which stretch themselves a little while after the Eggs are fallen into the Womb, and change into two membranes, called *Amnios* and *Chorion*. And as these two membranes are alwaies found afterwards, enwrapping the Child ; so 'tis very probable, that the Eggs of Women are also cover'd with two skins from their beginning, though by reason of their fineness I could not distinctly see them.

It seems, that *Fallopins* hath seen these Eggs before me ; as appears in his *Anatom. Observations*. And as to their Use they have in Generation, it seems easie to be determined, by

by reflecting on what that very expert Anatomist *Thomas Wharton* teacheth in his *Treatise of Glandulls* ch. 33. concerning the manner of Conception. For, according to him, *Semen Viri penetrat in testes feminae per uteri Tubas*. Now there it is joyned with the Egg, in such a manner, which hath not been explained till now, but is never the less certain, and much resembling to what comes to pass in the other oviparous animals.

The Egg being made thus second, descends into the womb through the *vasa deferentia*, and in two or three days grows of the bigness of a black Cherry. When they fall down, they are a little bigger than we have represented them; but being soft, they are easily flatned, and never remain round. If in falling they are handled and slightly pressed, there will stick a little skin to the finger, which shews that 'tis not seed, nor any thing like it, but of such Eggs, as we speak of. *Feminae de-jiciunt hæc Ova imprimis tempore menstruorum, vel in Ira vehe-mentia.*

I have had (saith *Kerckringius*) an occasion favorable enough for examining that *Germe* of three or at most four daies, represented *Fig. V.* A married Woman dyed 3 or 4 daies *post fluxum menstruum*. I assisted at the opening of her Body, and having found in the *matrix* a little round mass of the bigness of a great black Cherry, I took the husband aside, and asked him, *Num à tempore fluxus menstruorum uxorem cognovisset?* And having received for answer, that he had, I pray'd him to let me carry home with me this little ball, which I had found in her womb. I was no sooner come home but I open'd it, and found, that nature had wrought with so much activity in so small a time, that one might already see the first lineaments of a Child, since we observed in it the head as distinct from the Body, and in the head we took notice of some traces of its principal organs. As for the rest of the Body, it was nothing as yet but a masse grossly wrought, as you may see in this *Figure*.

But further, the *Embryo* represented in *Fig. VI.* was only of 15. daies, when in its Head there were noted the Eyes, Nose, Mouth, and Ears; and the Body began to have Leggs and Armes.

Armes, as well distinguishable as appears in this *Figure*; which represents it just as it was given me. I durst not yet attempt to separate the Flesh from these little Bones, or rather from these small Cartilages, which in time become Bones; all these parts being yet too tender to make an accurate dissection of them.

In *figure VII.* is delineated a child, which is already furnished with all its Cartilages, though it had been conceived but three weeks. It being fallen into my hands, I attempted to sever the skin and the flesh from the Cartilages, holding the place of the Bones, and I succeeded well enough in it, and keep still by me the *Skeleton* thereof, truly represented in this *Figure*. The Head, wherein the Brain is to lodge and all mans wisdom, is nothing but a simple membrane inflated with wind or Spirits. The Armes are distinct from the Body, and the Hands have now their fingers perfectly distinct. One may easily count in this contexture of Cartilages, how many Ribbs there will be. And lastly the distinction of the Toes of the Feet is as perceptible, as that of the fingers of the Hands. But we must add withall, that all these parts are no longer then hairs, and consequently a great dexterity and niceness is to be used for displaying them.

Figure VIII. represents a *fetus* of a moneth, having now the whole humane shape, and the Bones thereof firm enough in many places to support the parts. Behold the *Figure* well, which represents this little Engin in its natural size. It already in a manner sustains it self. The two Jaw-bones appear; the clavicles are formed; and all the Ribbs are very distinct, except the first and last; which are not wont to have, even in the *Second* moneth, the consistence of Bones. One may see in the Armes the Joynts of the Shoulder-bones and of the Elbows; as also the Thighs and both the Leggs, together with their bones, called *Focils*; which I had not observed, when I wrote my treatise of the *Generation of the Bones*. All what you see of white in this *eight figure*, hath at this time the quality of bones. Where I have a fair occasion to enlarge and to discuss that great question, whence proceeds the hardness in Bones? And I could not give a better, nor a more curious reason for it, than by alledging the doctrine, that serveth for a ground to all Chymistry;

mistry; which is that there is an *Acid Spirit*, universally diffused through the world, which giveth solidity not only to Bones, but also Minerals and Mettals, and to all Vegetables; penetrating all, fixing all, and being the Father of the Hardness and Solidity in all bodies.

Fig. IX. represents a Child of six weeks after Conception: where it is to be noted, that comparing together the Bones of divers foetus's it will be found, perhaps to admiration, that that which have been conceived but a little time after an other, hath yet the bones in proportion twice as big. That which is here exhibited by *Fig. IX.* appears much lesser than an other of two months, as appears in my Book of the *Generation of Bones*; but the Bones are for all that no less remarkable: for whatever hath the hardness and consistence of Bones in *that*, hath already the nature of Cartilages in *this*. The inferior jaw-bone is most observable in this Child of 6. weeks, marked A, it being at this age composed of six little bones, which when it is born are all joyned together, and make but one.

If it be asked, How I come to know, that these degrees of growth come to pass exactly within those times recited; especially since in abortions we often see *Embrio's* of 4 moneths and above, that are not so big as those spoken of? I might answer by repeating all I said before, when I compared the proportions of those different Germes. To which I shall only add, that *Embrio's* which miscarry have often remain'd a long while in the Body before they came forth, or have lived there so sickly as not to draw perhaps half the nourishment, necessary for them, and therefore much less than else they would be.

So far *Kerkringius*; on whose discourse are made these Reflexions by Monsieur *Denys*.

1. That those Eggs are generated in *Feminarum testiculis*, and thence made to descend *per tubam* into the matrix, *in coitu*, *per vim spirituosam seminis masculi*, *per uteri tubam penetrantis*.

2. That those Eggs are of different bignesses; since those of the third *Fig.* represent one according to the life, as it

was found with 9, or 10 lesser ones in a woman of 40 years of age. Such as were found by him in the testicles of a Cow, are duly exhibited in Fig. fourth. If any do wonder, that in so big an animal they should be so much smaller then in a Woman; he will have more cause to admire, that Women have them so little in comparison of those of Ducks, Hens, &c. the first beginnings of things not bearing alwaies a proportion to their state of encrease; as Beanes and Peas (*e. g.*) whence grow plants but of a very midling size, are much bigger seeds, than the kernels of Apples and Pears, which do produce considerably big Trees. Besides, it may be, that Cowes, when in their heat, may afford bigger Eggs. Mean time the reason why the Eggs of Fowl are alwaies proportionably bigger than those of Women and of Quadrupeds, is, that they, when laid, must contain the matter not only for forming, but also for feeding the young animal.

3. That this Opinion is not so new, as some imagine; since *Fallopins* in *Observ. Anatom. Bartol.* Anat. reform. l. 1. c. 26. *Riolan.* *Ench. anat.* l. 2. c. 37. *Laurent.* Anat. l. 7. c. 10. make mention of them.

But here we shall observe the *True state of the Question* out of the *Journal* of Monsieur *Gaulois*, saying, that the vesicles or Eggs in all sorts of femals, are to be considered in three conditions: 1. When they are fastn'd to the place where nature hath lodg'd them as in a repository. 2. When they are loosn'd from thence. 3. When they enclose the *Embrion*. The first of these, namely, that there are vesicles in all sorts of Femals, fastn'd to their Bodies, is certain, and not new; as appears by the Authors just now quoted. It is also certain, that after conception, that which encloseth the *Fætus*, is almost like an Egg; but this is not new neither, seeing that *Hippocrates* hath observed it lib. *de natura puer*; and *Aristotle* hath said it more than once, viz. l. 7. hist. Anim. c. 7. and l. 3. de gener. Anim. c. 9. To which also the moderns agree and amongst others the famous *Harvey* Exper. 68. de gener. Anim. The *Question* therefore is only, Whether these Vesicles, fastn'd to the body of Femals, are loosn'd from it; and whether that kind of Eggs, wherein the *Embrion* is form'd, is one of the vesicles loosn'd?

loosn'd? And here *Kerkringius* asserts the affirmative; as hath been seen above. Those that are of the contrary Opinion, say, that it is sure, that that bladder, like an Egg, in which the *fetus* is form'd, comes not from elsewhere; since 'tis known, that it is produced in the place of conception, and even how it is there produced; as appears out of *Harvey*, *ibid.* & tract. de Concept. Besides, say they, the vesicles found in the body of Women, are so fastn'd there, that naturally they cannot be separated from thence; and suppos'd they were loosn'd, there is in the same place, where they are, no passage large enough to get through. They add, that if you will give the name of Eggs to all the vesicles, to be found in the parts of Generation, there would also be Eggs in the body of Men, it being known, that at the side of the *vasa deferentia* there are found divers vesicles, which *Anatomists* compare to a Cluster of Grapes by reason of their figure.

The Reader, saith this *Journalist*, is left to decide this Question. He only intimates, that in the many Animals, dissected in the Royal Philosophical Academie at *Paris* there were never found any vesicles actually loose. But that, as to a passage for them, there had been, 3 years since, dissected a Woman, and found in each of the *tubæ uteri* a manifest cavity going into the bottom of the *matrix*: Adding, that though these conduits appear not open ordinarily, they may yet dilate themselves at the time of Conception: As the conduit, through which the Eggs of the Fowl do pass out of the *ovarium* into the *matrix*, is usually very close; but yet opens sometimes.

4. To return to M. *Denys*, he observeth, that all other animate creatures (not to speak now of Plants) are produced by the means of Eggs; as Birds, Insects of all sorts, Fishes (of which last sort though Whales, Sea-Calves and Dolphins bring forth live creatures of their kind, yet they first breed them within their Bodies in Eggs:) And why not Quadrupeds also and the Femals of Mankind?

5. As for Eggs, said by *Kerkringius* to have been found in *Virginibus*, the same M. *Denys* esteems that probable enough. For, saith he, though we had not the Instance of Hens, lay-

ing Eggs without any congress of a Cock ; the place where they are bred shews enough, that Man contributes nothing to their production ; all that he can do, being nothing but an attraction of the Eggs out of their Conservatory, and the making them descend into the *uterus*, *ut ibi irrorentur à semine, & fecunditatem acquirant* ; even as the Juices of the Earth do vivifie all the Plants by insinuating themselves into the grains, and penetrating their skins. And it may be, it is the alteration that befalls these Eggs, when they are retained too long, which causeth the abundance of Vapors and disorders, which other parts are accused of. On which occasion he alledgeth a notable example of a young Maid of quality, that lately died in the 18th year of her age ; who was subject to very frequent Hysterical fits of vapors, of which she was one day assaulted with so great violence, that it cost her her life. Her Body being opened, *Testiculus dexter erat flaccidus, & figuræ solitæ ; at sinister adeò tumidus & inflatus, ut Ovi Anatis æquaret magnitudinem : Eoque aperto, Ovum fuit intus repertum, Olivam figurâ & magnitudine referens, & separatu nequaquam difficile.* This, he saith, is still kept by Monsieur Charas.

N. B. Since these particulars were sent to the Press, there came to the Publishers hands the very lately printed Book of that diligent and expert Anatomist *Regnerus de Graaf*, intituled *Tractatus novus de Mulierum Organis generationi inservientibus* ; in which the above-recited difficulties, moved by M. Gaulois, and others also, are amply taken notice of, and ingeniously solved : Concerning which, we may by the next opportunity give the Curious-Reader a fuller accompt ; as also, wherein the said *De Graaf* differs from *Kerkringius*, in this matter, which, for want of time, could not be done at present.

I. PLANTARUM UMBELLIFERARUM *Distributio nova per Tabulas COGNATIONIS & AFFINITATIS ex Libro Naturæ observata & detecta ; A. Rob. Morison Med. & Prof. Botan. Regio, &c. Oxonii è Theatro Sheldoniano, 1672. To be sold by John Martyn at the Bell in St. Pauls Church-yard.*

THis Excellent Botanist, having with indefatigable industry and uncommon sagacity observed and discovered out of the Book of Nature a general and genuine Method, reducing all Vegetables to certain infallible *Classes* or Heads, by Tables of Affinity or Cognation ; hath in this Book given an *Essay* of the same, by reducing that Family of Plants, commonly called *Umbells*, to their subaltern kinds, from the different Shape and Form of their *Seeds* : Intending, if he do further meet with suitable encouragement and assistance, to publish the whole Method and Work, in a manner lying ready by him, and tending so much to the advancement of a vast part of Natural History.

This *Specimen*, being but the *thirtieth* part of the whole, first assigneth very succinctly to the *Umbelliferous* Plants that common Character, wherein they all agree amongst themselves, and are differenced from all other families ; and then reckons up their several, both intermediate and ultimate, species's, together with their respective subordinate and characterical discriminations. By which way the Students of Botanicks will henceforth be able to learn from Nature it self, with much order, clearness, and ease of memory, all sorts of Plants by their supreme *genus's*, intermediate kinds, and lowest *species's*, and their particular varieties ; without a tedious perusal of voluminous Books, and an irksome expence of Time.

And as this Experienced Author taketh the *Generical* and Essential marks of Plants from their *Seeds* ; so he taketh the *Specific* differences of their several particular families under one common Head from their less noble parts, as the Root, Leaf, Flower, Stem, Scent, Taste, and Colour.

The Reader then will in this *Essay* find performed these five things : First, a *Generick* Note both of the highest and subaltern *genus's* of the *Umbells*. Secondly, a *specific* mark proper for each *species*. Thirdly, the duration of every *species*, whether annual or perennial. Fourthly, the Place of their growth, together with their peculiar temperament, vertues, and names. Fifthly, the Authors animadversions on the errors and mistakes of *C. Bauhinus*, and other Authors, that have written on this argument.

The whole adorned and illustrated with very curious and exceedingly accurate *Cuts*, furnish'd at the charge of several of the Generous and Learned members of the Famous University of *Oxford*, and engraven by that rare Artist Mr. *Loggan*.

N.B. Since the writing of this Account concerning this usefull work, we are informed by the Author thereof, that he already findeth

eth so much encouragement for the prosecution thereof, that he little doubts, but that about the end of this present Year he shall have finish'd in the same Press, where this beginning was made, at least five or six *Sections* more, which shall be,

1. *Legumina & Trifolia.*
2. *Frumenta & Gramina.*
3. *Planta Stellata, lactescentes & papposa; lactescentes & non papposa; papposa & non lactescentes.*
4. *Triquetra, bicapsulares, & mollientes.*
5. *Corymbifera.*
6. *Galeata & Verticillata.*

II. ΛΟΙΜΟΛΟΓΙΑ, sive PESTIS nupera Londini grassantis Narratio Historica. Auth. Nathan. Hodges M.D. &c.

THe Author of this Book, having kept his station as Physician in the City of *London* during the last Plague, maketh it his business to give us here an Historical Account of what he then observed and practised in this fatal Distemper; which he doth in 8 *Sections*.

In the *First* he declareth the Original and Progress of this *London-Plague*.

In the *Second* he delivers his Opinion about the principal Cause of the Pestilence in general; which he conceiveth to be a very subtle Nitrous Spirit, breathed out of the Earth into the Air, and by the Air conveyed into our Bodies, and thence by contagious steams diffused and communicated to others. Where he also discourses of the noxiousness of eating the flesh of Cattle that dyed of themselves, as causing a great Cachexy in the body of man, and exceedingly disposing it to take the Plague: adding withall the difference, there is between the Contagion in Cattle from that in Men; which he maketh to be not in kind, but in degree only.

In the *third* he examines the primary Seat of the Plague, and esteems that to be the *Spirits*, whence 'tis transmitted into the Body and *Viscera*, infected by their influx.

In the *fourth* he considers the Affinity between the *Plague* and *Scorbute*, and saith, that these two do frequently coalesce into one, because of their agreement in a Salin principle. Where he also takes notice of divers odd instances of diseases, as the *Consumption* and the *Kings Evil*, which upon the Plague supervening were cured, the persons surviving; As also of some *Podagrical* people, that happening to be seized by the Plague, lost the Gout, and recover'd of the Plague too.

In the *fifth*, he discourses of the manifest signs of the Plague, as well of those of its first Invasion, as those that immediately ensue upon the same; among which he reckons a Fever as a common, yet not inseparable sign; a palpitation of the Heart; (which he hath observed to be sometimes so strong and loud, that it may be heard at a considerable distance :) item Blains, Bubo's, Carbuncles, Tokens, &c. Where he animadverteth upon the opinion of Doctor *Diemerbrook*, importing, that Bubo's are produced by an occursion of a salin

and

and acid humor, making an ebullition, as when Spirit of vitriol is poured on Salt of Tartar. In the examination of *Carbuncles* he inquires, How in the human Body can be generated so sharp and caustick an humor, as is that in Carbuncles; and also, how Nature comes to separate it from other liquors. Where he reflects again upon the assertion of the lately mentioned *Diemerbrook*, who makes a pestilential Carbuncle nothing but a Gangrene *in fieri*; and observeth withall, that those Carbuncles will appear in every part of the Body, he having seen one upon a Womans breast presently after she had been delivered of a Child; which sucked her during her distemper without any inconvenience; the Mother her self recovering also soon after. Further, he takes notice of the pestilential *Tokens* as certain messengers of Death: where he relates some Examples of persons, in whom they came out without any trouble to the Body, but yet killed them afterwards. Here he gives notice, that some wicked and crafty Nurses, to hide the *Tokens* in dead Bodies, do cover them presently after death with moist linnen sheets; whereby the fermentation of the venenat humors being quelled, and the pores closed, the Searchers may be deceived, and so not cause the House to be shut up.

In the *sixth* he treats of the *Prognosticks* of an Imminent Plague; among which he reckons chiefly the change of Chronical diseases into Acute ones with violent Symptoms; and a great Murrain among Cattle. Here he noteth, that a Plague very cruel at first, is of short duration; as also, that what time it taketh from its Beginning to its Hight, the same it taketh from its hight to its Period. Besides, he observes the Presages of Death to be, an Hemorrhagy, *Fluxus menstrua*, a Loosness, a Dysentery, green or black Excrements. He also taketh notice, that weak Lungs do not escape; that the first Sweats coming without ease to the Patiens; a long nauseousness, and the subsiding of *Bubo's* without sweat; ill-coloured and blackish swelling, &c are fatal; and that *Carbuncles* are worse than *Bubo's*. From the *Urine* he esteems no certain prognosticks can be made, since commonly it appears as good in the Plague, as that of healthy persons. And the *Pulse* he counts in this distemper a very uncertain and fallacious sign.

The *seventh* delivers his Method of Curing, which he placeth both in the Encouragement of the Patient, and in the Use of Generous medicins; without venæ-section, and (unless in the case of a surfer and a foul stomach,) without vomiting and purging; here being requisite a Separation rather than an Evacuation, and the Seat of this Disease being not in the Juices of the Body, but in the Spirits.

Of *Antidotes*, the principal means of Cure, he specifies those which he considers as some of the choicest, taken from Vegetables as well, as Animals and Minerals. And here he expresseth a particular value for Ginger, both in powder for sweating, and in Confit for preventing; as also for the *Bezoardicum Minerale*: But *Bezoar* and *Unicorns Horn* he esteems of greater price than vertue. He commends *Spirit of Harts-horn*, as an excellent Diaphoretick. He particularly describeth those, which he chiefly made use of with good success, from the prescripti-

ons of the *Colledge*, and of *Sr. Theod. Mayern*. This part he concludeth with his method as to the regiment of Life, and his way of treating all sorts of pestilential Tumors.

In the *Eighth* and last he discourseth of the means preventing the Plague; of which he considers *some* to be *General*, and those *both* of *Nature*, as strong Northerly winds; and of *Art*, as great Guns discharged morning and evening, as also appropriat perfumes, by burning resinous, but not sweet-scented, wood. Other means are, *particular* Amulets; concerning which the Reader may consult the Author himself.

To the whole is annexed an Account of the regiment of life, which the Author himself used; as also a *List* of those that dyed of the Plague this year, which amounted to 68596. besides 29000. that died of other diseases during that time.

III. *A Philosophical Essay, declaring the probable CAUSES of STONES in the Greater World, in order to find out the Causes and Cure of the Stone in the Kidneys and Bladder of Men: by D. Thomas Sherley, Physitian in Ordinary to his Majesty, Londini in 80.*

THE Ingenious Author of this Essay having proposed to himself to publish a Medicinal Tract concerning the most probable Cause of the Stone in the Bodies of Animals, found it necessary to premise this Inquiry into the Causes and Nature of Petrefaction in the greater World in general; to see, whether the Causes be not the same in both, or at least bear not some analogy or resemblance to one another.

In the doing of which, he thought good to relate a number of select Histories of Petrifications, and then to examine the causes by which they were performed. In which latter part, having waved the *Aristotelian* doctrine of this point, nor found a full satisfaction in that of the vulgar *Chymists*, he closeth with that ancient *Hypothesis*, which imports, that Stones and all other Sublunary Bodies are made of *Water* condensed by the power of *Seeds*, which by the vertue of their fermentive Oudours perform these transmutations upon Matter. For the better understanding of which, he premises some Generals, and then descends to particular proofs of what he asserts: concerning which we can do no better than to remit the Reader to the Author himself.

IV. *Caroli Claromontii M.D. &c. de AERE, SOLO, & AQUIS Angliae; deque MORBIS Anglorum vernaculis Dissertatio: Nec non Observationes Medicae CAMBRO-BRITANNICAE. Londini Impensis Joh. Martyn, sub signo Campanae in Coemeterio D. Pauli, 1672. in 120.*

THE Author of these two Tracts, endeavours in the *one*, to give an account of the Scituation, Air, Soyl, and Waters of *England*; as also of the Temper, Dyet, Exercises, and chief Sicknesses of the Inhabitants thereof: In the *other*, he maketh it his business to deliver several Histories of Diseases, to the number of 26, managed by himself in *Wales*; which he doth, by describing the nature of each of those Maladies, by adding his ratiocinations thereon, by giving their Indications, and shewing his Method of Cures, together with the Events of them.

ERRATA in this Numb. p. 4006. l. 2. after these words, 1 foot long, add; which did represent the said Crown; no greater bigness than you see Fig. 3. in Tab. 1 p. 4012. l. 8. r. flexilis. p. 4020. l. 1. r. perception. p. 4022. l. 19. r. no bigger.

LONDON, Printed for John Martyn Printer to the Royal-Society. 1672.

PHILOSOPHICAL TRANSACTIONS.

April 22. 1672.

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Mr.

Mr. Newton's Letter to the Publisher of March 26. 1672. containing some more suggestions about his New Telescope, and a Table of Apertures and Charges for the several Lengths of that Instrument.

S I R,

Since my last Letter I have further compared the two Telescopes, and find that of Metal to represent as well the Moon, as neerer Objects, something distincter than the other. But I must tell you also, that I am not very well assured of the goodness of that other, which I borrowed to make the Comparison; and therefore desire, that the other Experiment should be rather confided in, of reading at the distance of between a 100 and 120 foot, at which I and others could read with it in the *Transactions*, as I found by measure: At which time the aperture was $1\frac{1}{3}$ of an Inch; which I knew by trying, that an obstacle of that breadth was requisite to intercept all the light, which came from one point of the object.

I should tell you also, that the little plain piece of metall, next the eye-glass, is not truly figured: whereby it happens, that objects are not so distinct at the middle as at the edges. And I hope, that by correcting its figure, (in which I find more difficulty than one would expect,) they will appear all over distinct, and distincter in the middle than at the edges. And I doubt not but that the performances will then be greater.

But yet I find, that there is more light lost by reflection of the metall which I have hitherto used, than by transmission through glasses: for which reason a shallower charge would probably do better for obscure objects; suppose such an one, as would make it magnifie 34 or 32 times. But for bright objects at any distance, it seems capable of magnifying 38 or 40 times with sufficient distinctness. And for all objects, the same Charge, I believe, may with advantage be allowed, if the steely matter, imployed at *London*, be more strongly reflective than this which I have used.

The performances of one of these Instruments of any length being known, it will appear by this following Table, what may be

be expected from those of other Lengths by this way, if Art can accomplish what is promised by the Theory. In the *first* Column is expressed the Length of the Telescope in feet; which doubled gives the semidiameter of the Sphere, on which the concave metall is to be ground. In the *second* column are the proportions of the Apertures for those several Lengths. And in the *third* column are the Proportions of the *Charges*, or diameter of the spheres, on which the convex superficies of the eye-glasses are to be ground.

Lengths.	Apertures.	Charges.
$\frac{1}{2}$	100	100
1	168	119
2	283	141
3	383	157
4	476	168
5	562	178
6	645	186
8	800	200
10	946	211
12	1084	221
16	1345	238
20	1591	254
24	1824	263

The use of this Table will best appear by example: Suppose therefore a half foot Telescope may distinctly magnifie 30 times with an inch Aperture, and it being required to know, what ought to be the analogons constitution and performance of a four foot Telescope: By the second column, as 100 to 476; so are the Apertures, as also the number of times which they magnifie. And consequently since the half foot Tube hath an inch aperture and magnifieth 30 times; a four foot Tube proportionally should have $4\frac{76}{100}$ inches aperture, and magnifie 143 times. And by the third column, as 100 to 168; so are their Charges: And therefore if the diameter of the convexity of the eye-glass for a half foot Telescope be $\frac{7}{8}$ of an inch, that for a four foot should be $\frac{168}{500}$, that is, about $\frac{1}{3}$ of an inch.

In like manner, if a half foot Telescope may distinctly magnifie 36 times with $1\frac{1}{4}$ of an Inch Aperture; a four foot Telescope should with equal distinctness magnifie 171 times with 6 inches Aperture; and one of six foot should magnifie 232 times with $8\frac{2}{3}$ inches Aperture; and so of other lengths. But what the event will really be, we must wait to see determined by experience. Only this I thought fit to insinuate, that they which intend to make trials in other lengths, may more readily know how to design their Instruments. Thus for a four foot Tube, since the Aperture should be 5 or 6 inches, there will be required a piece of metal 7 or 8 inches broad at least, because the figure will scarcely be true to the edges. And the thickness of the metal must be proportional to the breadth, least it bend in the grinding. The metalls being polished, there may be tryals made with several eye-glasses, to find, what Charge may with best advantage be made use of.

An Extract of another Letter of the same to the Publisher, dated March 30. 1672. by way of Answer to some Objections, made by an Ingenious French Philosopher to the New Reflecting Telescope.

SIR,

I Doubt not but *M. A.* will allow the advantage of reflexion in the Theory to be very great, when he shall have informed himself of the different *Refrangibility* of the several rays of light. And for the pratique part, it is in some measure manifest by the Instruments already made, to what degree of vivacity and brightness a metaline substance may be polished. Nor is it improbable but that there may be new ways of polishing found out for metal, which will far excell those that are yet in use. And when a metal is once well polished, it will be a long while preserved from tarnishing, if diligence be used to keep it dry and close, shut up from Air: For the principal cause of tarnishing seems to be, the condensing of moisture on its polished surface, which by an Acid spirit, where

wherewith the Atmosphere is impregnated, corrodes and rusts it; or at least, at its exhaling, leaves it covered over with a thin skin, consisting partly of an earthly sediment of that moisture, and partly of the dust, which flying to and fro in the Air had settled and adhered to it.

When there is not occasion to make frequent use of the instrument, there may be other waies to preserve the metal for a long time; as perhaps by immersing it in Spirit of wine or some other convenient liquor. And if they chance to tarnish; yet their polish may be recovered by rubbing them with a soft piece of leather, or other tender substance, without the assistance of any fretting powders, unless they happen to be rusty: for then they must be new polished.

I am very sensible, that metal reflects less light than glass transmits; and for that inconvenience, I gave you a remedy in my last Letter, by assigning a shallower charge in proportion to the Aperture, than is used in other Telescopes. But, as I have found some metaline substances to be more strongly reflective, and to polish better, and be freer from tarnishing than others; so I hope there may in time be found out some substance much freer from these inconveniences, than any yet known.

Observationes.

Observationes JOVIS ad duas Fixas transeuntis, *Derbie* Anglorum habitæ mensibus Febr. & Martii A. 16 $\frac{71}{72}$. ft. veteri à *Joh. Flamsteed*.

— **M**itto Tibi duos Jovis transitus, accuratè, ni fallor admodum, observatos, posteriorem imprimis; adeò ut (absit dicto jactantia) paucas, inter observationes hætenus factas, hisce equiparandas crediderim. Impertiri eas poteris quibuscunque volueris. Invenies utique, Rudolphina loca Jovis magis errare quàm Carolina: qua de re Clarissimum Hevelium, qui Tabulas istas omnium quæ extant optimas arbitratur, moneri velim.

Martii 19. & 27. novissimis, aliquot habebam Observationes maxime elongationis quarti Satellitis à Jove, eamque deprehendi (minimum) $24\frac{1}{2}$ semi-diametros Jovis ab ipso Jove, vel $24\frac{3}{4}$ juxta Generosum & Doctum Townlejum; non verò 23, ut Dn. Cassinus autumat. Ex eo tempore observare ulterius, ob lentem meam objectivam casta vitiata, non licuit.

Sequuntur Observationes ipsæ.

AD Jovis loca & latitudines in Ephemeridibus Heckeri consignata advertens, comperi, ipsum cum Fixa Lucis 4^a (cujus latitudo $1^{\circ}.40'$. Ber. locus mihi $14^{\circ}.7'.16''$; at Streetio, $14^{\circ}.3'.54''$.) junctum, ire secundum longitudinem, Febr. 13. h. 6. p. m. sed cum latitudine minori $11''$. Mecum propterea constituebam, ad hunc Transitum attendere. At nubes & pluviosæ noctes observationem distulere ad —

16. Februarii, quo die, celo satis serenante, ad observationem me accinxi, & h. 7. $44\frac{1}{2}$, alto $418^{\circ}.10'$, ejus à Fixa distantiam Tubo longiori dimensus sum, $16'.33''$. & differentiam altitudinum centrorum 4° & $1'.1''$. nocte sequente.

17. Febr. h. 7. $25'$. p. m. alto $415^{\circ}.54'$. ipse à Fixa distitit $50''$; altitudinum differentia erat $8'.40''$. Eadem nocte, h. 8. $59'$. vel forsan 1. min. maturius, Satelles primus ad dextram 4° , in ipsius umbram incidit, adeo tamen evanescentis exigua erat à limbo distantia, ut quanta fuerit dijudicare non potuerim.

18. Febr. h. 7. $0'$. Fixæ distantia à centro 4° erat $28'.15''$; altitudinum differentia circ. $15'.29''$. In utraque observatione Erro altior erat Fixæ, à qua semper Meridianum versus stetit.

Iniro dein calculo ad dies singulos & horas Observationum, investigavi

	d. h. ,	d. h. ,	d. , °.
Februar.	16. 7. 44 $\frac{1}{2}$	17. 7. 25	18. 7. 0.
Jovis à Fixa longitudinem in Antecedentia	0. 9. 16	0. 17. 22.	0. 25. 12.
Latitudinem ad Austrum ab ea	0. 13. 30.	0. 13. 14.	0. 12. 43.
Ergo 4 ^{ta} Latitudo Borealis ———	1. 26. 30.	1. 26. 46.	1. 27. 15.
Locus vernus ——— { Mihi m	13. 58. 0.	13. 49. 54.	13. 42. 4.
Streetio	13. 54. 38.	13. 46. 32	13. 38. 42.
Locus Jovis è Tabulis Streetii Carolinis m	13. 48 39.	. . .	13 32. 59.
Latitudo vera Borealis ———	1. 29. 31.	. . .	1. 29. 40.

At in Ephemeridibus Heckeri locus Jovis m 13°. 45'. latitudo 1°. 29' +, ita ut totis 13'. in longitudine à celo dissideant; dum Authori Carolino (suo Fixæ concessio loco) error non ultra 6'. excedat: Uterque verò (minimum) 2'. 25", ne dicam 3', erret in Latitudine.

Martii 15. (st. v.) vesperi, observare cœpi Jovis distantias & positiones à Stella Ω 38, cujus latitudo 1°. 20 $\frac{1}{2}$ Bor. Locus Streetio m 9°. 54'. 0"; mihi verò m 9°. 57'. 20". hor. 7. 25'. p. m. alto 4 32°. 52'. Distantia centri ipsius ab ipsa 33'. 50". Altitudinum differentia circit. 20'. 42".

Mart. 16. h. 7. 48'. alta fixa 36°. Jovis ab ea distantia erat 27'. 7". Altitudo minor 16'. 3".

Noctibus Martii 17. & 18. ob nubes & ventos intermissæ observationes.

Mart. 19. varias habui, nec inaccuratas. Alto 4 49°. 35'. i. e. h. 6. 45', Fixa altior erat quàm Planeta 2'. 24"; à quo h. 6. 55'. distitit 10'. 21". Hor. 4. 11'. limbus Planetæ remotissimus à Satellite 4to, in maxima ferè elongatione sito, distabat 9'. 37". Satelles idem à Fixa, 7'. 28". Interim Satelles primus ad limbum 4is appropinquabat, cui h. 7. 51'. jungebatur. Etiamnum Erro semper altior apparuit, sed verè fuit depressior quàm Fixa: postea humilior visus est, sed reverà fuit altior.

Mart. 20. melius preparato ad Altitudinum differentias capiendas Micrometro, Observationes habui (sic putem) accuratissimas, quæ sequuntur.

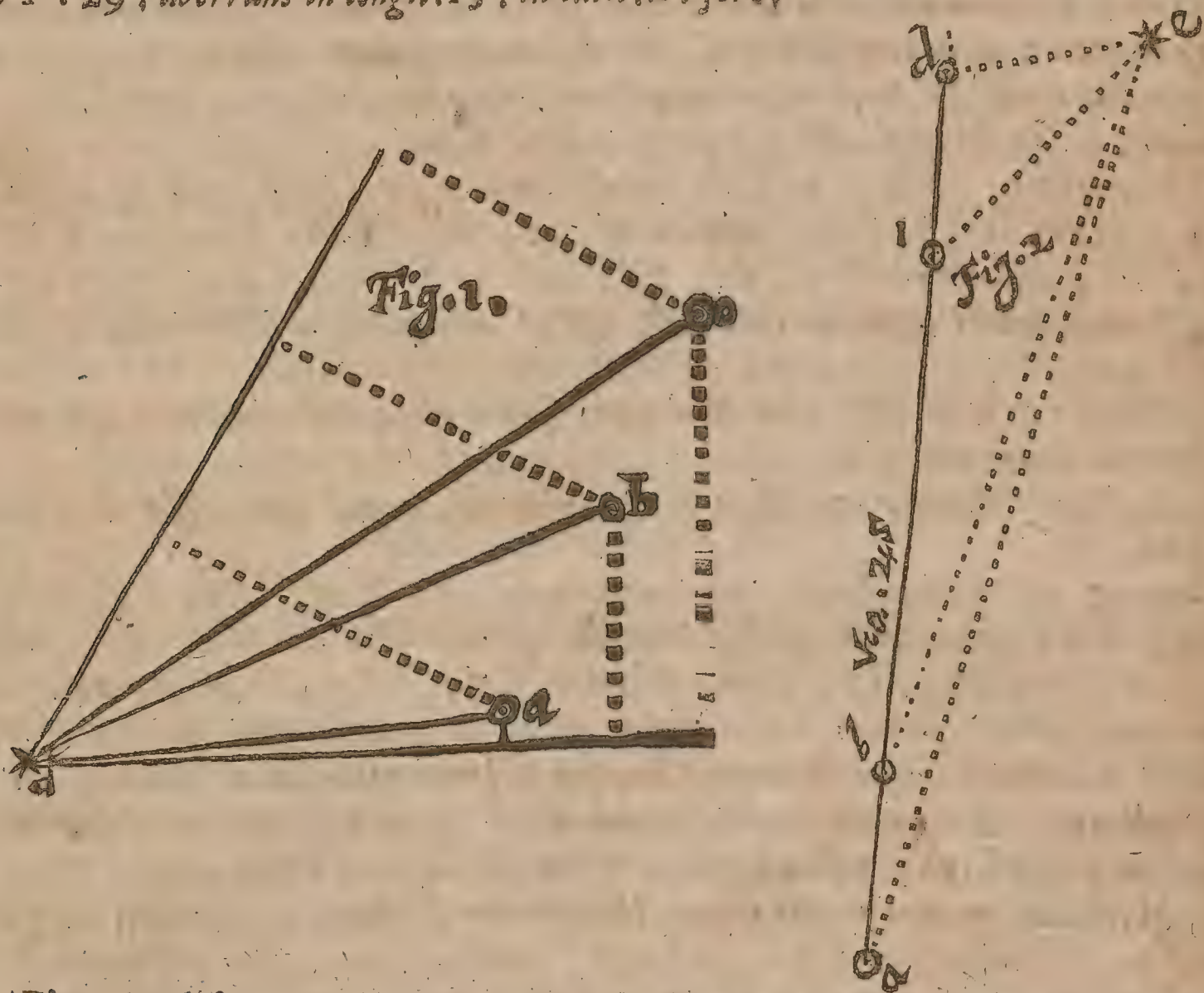
4. alto	h. ,		" "
30. 0.	6. 44 $\frac{1}{2}$.	Jovis centrum verè altius erat Stellâ ———	2. 13.
30. 47.	6. 51.	Altitudinum eadem differentia rursus capta ———	2. 14.
32. 0.	6. 59.	Jovis centrum à Fixa distitit ———	7. 0.
38. 30.	7. 54 $\frac{2}{3}$.	Centrum Jovis verè altius Fixâ ———	3. 14.
40. 50.	8. 18 $\frac{2}{3}$.	Altitudinum differentia denno capta ———	3. 42.
		Et deinde Centrorum distantia erat ———	7. 5.

Ad locum Jovis ex his Observationibus acquirendum, Angulos circuli verticalis.

ticalis cum Ecliptica supputavi ad h. 6. $51^{\circ}\frac{1}{2}$ & h. 8. $18^{\circ}\frac{2}{3}$. quos invenire

Jovis erat à Fixa distantia	7. 0".	7. 0".
Altitudinum differentia	2. 14.	3. 42.
Ergo, ¶ erat in consequentia Fixæ	2. 3.	1. 44.
cum Latitudine majori	6. 42.	6. 47.
Quare Jovis latitudo vera	1. 27. 12.	1. 27. 17.
Locus verus	Streetio } m 9. 56. 3.	9. 55. 44.
	Mihi } 9. 59. 23.	9. 59. 4.

Jovis locus è Tab. Carolinis supputatus h. 8. 19° . erat m 9° . $49'$. $40''$. deficiens ab Observatione $6' 4''$. Latitudo vera $1^{\circ} 28' 57''$. excedens observatam $1' 40''$. In Ephemeridibus Heckeri Jovis locus m 9° . $45'$. Latitudo $1^{\circ} 29'$, aberrans in longit. $13'$. in latit. $2'$. fere,



In Fig. 1. exhibetur Fixa in m 14° . $7'$ & Jovis apparens positio, h. 7. circit. vesp

- a. est ¶ Observatus Feb. 16.
- b. est ¶ obs. Feb. 17.
- o. est ¶ obs. Feb. 18.
- d. est Fixa Ω 24.

In Fig. 2. exhibetur transitus ¶ per Fixam in m 9° . $57'\frac{1}{2}$. h. circ. 9. vesp.

- a. est ¶ observ. Martii 15.
- b. est ¶ obs. Mart. 16.
- i. est ¶ obs. Mart. 19.
- d. est ¶ obs. Mart. 20.
- e. est Fixa Ω 38.

In Ephemeridibus Heckeri.

Maii 30. mane h. 4. ¶ ad Fixam in m 9° . $57'\frac{1}{2}$ directus regredietur & eius tamen latitudo erit modo $1^{\circ} 16'$; adeo $4\frac{1}{2}$ ad Austrum à * transibit.

Junii 30. ¶ transitur ad * in m 14° . $7'\frac{1}{2}$; ejus tamen latitudo erit modo $1^{\circ} 31'\frac{1}{2}$.

A Relation of the Return of a Great permanent Spot in the Planet Jupiter, observed by Signor Cassini, one of the Royal Parisian Academy of the Sciences.

TIS now above six years, that Signor Cassini published the Theory of two sorts of Spots, at certain times to be seen in the Disque of Jupiter*.

One sort are nothing but the Shadows of the four Satellits, which he had often very well observed, when these Satellits, moving through the lower part of their small circles that environ Jupiter, did pass between him and the Sun which illuminates him, making a kind of Solar Eclipse, like that which the Moon maketh, when she is between the Sun and the Earth. These Spots, as he observed from that time, have this peculiar, which distinguisheth them from all others, *that* they are precisely found in that place of Jupiter, where some Satellit is seen by the Sun; *that* they go from the Oriental limb to the Occidental of the Disque of Jupiter with a motion alwaies equal to that of the Satellit; *that* in respect to us they preceed the Satellit before the opposition of Jupiter to the Sun, and follow him after the opposition; *that* the further Jupiter is distant from the opposition, the greater is the apparent distance of the same Satellit; *that* at divers times of the Year this distance changeth in proportion of the annual Parallax of the Satellit, according as he is differently seen by the Sun and by the Earth; and *that* at one and the same time of the year, when divers Satellits happen to be between Jupiter and the Sun, the Spots correspondent to them are distant from them in proportion of the semi-diameters of the circles of the same Satellits.

The *other* sort of Spots have no dependance at all from the Satellits; but it seems, that they have some resemblance to those Spots that sometimes appear in the Sun, or to those that are alwaies seen in the Moon; and they are perhaps of the same nature with those, that are called *Belts*. These Spots do also move from the Eastern to the Western limb of Jupiter's disque; but their apparent motion is unequal, and swifter near the Center than the Circumference; and they never are so well seen as when they approach to the Center, they being very narrow and almost imperceptible, when they approach to the Circumference:

* What was discovered of the permanent Spot in this Planet here in England by M. Hook An. 1664. in May, may be seen N^o. 1. p. 3. compared with N^o. 4. p. 75. N^o. 8. p. 143. N^o. 12. p. 209. N^o. 15. p. 246.

ference : which makes us believe, that they are flat, and superficial to *Jupiter*.

Among these Spots of the second sort there is none so sensible, as one that is situate between the two Belts, which in the *disque* of *Jupiter* are ordinarily seen extended from east to west; the largest of which is between the Center and the Northern limb, and the narrowest is beyond the Center toward the Southern limb. This Spot is alwaies adhering to the *Southern Belt*; its diameter is about the tenth part of that of *Jupiter*; and at the time that its center is nearest to that of *Jupiter*, it is distant from it about the third part of the semi-diameter of that Planet.

Signor *Cassini*, after he had made many Observations of this Spot during the Summer of the year 1665, found, that the period of its apparent revolution is of *nine hours and fifty six minutes*; and having taken an *Epocha* of the time, when it arrived at the middle of the Belt, he calculated *Tables* and *Ephemerids* of its motion for the end of the said year 1665, and for the beginning of 1666. He continued to observe it until the beginning of 1666, when *Jupiter* approached to the beams of the Sun; and the Observations were found conform enough to his *Ephemerids*. But after it was got free of the sun-beams, this Spot was difficult to be discerned : And as this gave ground to believe, that it might be of the nature of the Spots of the Sun, which, after having appeared for a while, disappear for ever, Signor *Cassini* ceased at length to observe them.

But Jan. 19. of this present year 1672. (ft. n.) when he observed *Jupiter* at $4\frac{1}{4}$ a clock in the morning, he perceived in the same place of his *disque* the Figure of the same Spot, adhering to the same *Southern Belt*. It was already gone beyond the moiety of this Belt, and he saw it advance little by little towards the Western limb, to which it seemed to be very near at $6\frac{1}{4}$ a clock : But it then appeared so small and little, and so little sensible, that he was obliged to cease from observing it.

By the Celerity of its motion near the Center, and by the place where he had begun to see it, he judged, that it might have been in the midst of the *Belt* at 4 a clock and 35 min. in the morning : And as he prepared himself to make *Ephemerides* of its motion for this present year 1672, he perceived, that in those, he had made for the year 1666, by good luck, this Spot had been in the midst of *Jupiter* the same day, namely the

the 19th of *January* at the same hour in the morning, the reduction of hours being made by the difference of the *Meridians*. So that by the calcul he made, in six years, of which one is a *Bis sextile*, it is found to have made, in respect of the Earth, at least 5294 revolutions, each of 9 hours 55 minutes, 58 seconds, compensating one revolution by another; and at most 5295 revolutions of 9 hours, 55 minutes, 51 seconds; forasmuch as he was assured of the preciseness of one *Mean Revolution* to one eight of a minute: which will be verified by future observations. Thus the *Ephemerides* were found ready made for the first months of this present year, but only that we are a little differently to apply the Equations, that amount to some minutes, because that the distance, which *Jupiter* now is at from the Sun and from his Apogee, is different from that, which he was at in the beginning of the year 1666; and that in this present year after the month of *February*, that day is to be counted which hath been added for the *Bis-sextile*. The Observations, which Signor *Cassini* hath continued to make since the 19th of *January*, as far as the weather did permit, have alwaies been found conform to those *Ephemerides*.

Until then he had never yet seen an *immediate* return of this Spot after 9 hours and 56 minutes, because it had not hapned, that *Jupiter* after the apparition of the Spot had stay'd, in one and the same night, long enough above the Horizon, at least at a sufficient height to observe him with due distinctness. He had only concluded the time of this revolution by returns observed after about 20, 30, and 50 hours; and he had more precisely limited it by observations more distant. But the night after the 1 day of *March*, at 7 $\frac{1}{2}$ a clock in the evening, he saw this Spot in the midst of the Belt; and the same night, at 5 a clock and 26 minutes in the morning, he saw it again returned precisely to the same place. Next day he made a report of these Observations to the *R. Academy of the Sciences*, and predicted, that the Spot would arrive again at the midst of the Belt *March* 3^d at 9 a clock and 8 minutes at night, whereupon that Assembly deputed M. *Buot* and M. *Mariotte* to be present at the Observation; who being come to the *R. Observatory* began to see at 8 a clock and 4 minutes the Spot already somewhat removed from the Oriental limb, but yet obscure and small. At 8 a clock and 47 minutes they saw it very distinctly advancing

towards the middle of the Belt. From 9 a clock 5 minutes and 40 seconds, until 9 a clock and 8 minutes, they saw it in the midst of the Belt. At 9 a clock and 15 minutes it was passed the middle, and was come nearer to the Occidental limb. And a little after the Heavens being over cast, he could then observe it no further.

This Observation being taken for the *Epocha*, it is easie to find hereafter the times, when this Spot shall return to the midst of the Belt. For you are only to add alwaies 9 hours and 56 minutes, and, for greater precisenes's sake, not to omit the ordinary Equation of days, that depends from the inequality of the motion of the Sun in respect of the Equinoctial, nor the particular Equation, that depends from the inequality of the motion of *Jupiter* according to the diversity of the distance of the Sun and his Apogee.

This Revolution being the swiftest and the most regular that is hitherto known in the Heavens, a Travellour alone, even without having any correspondence with other Observers, may make use of it to find the *Longitudes* of the most remote places of the Earth. We shall hereafter examine, to what preciseness we may arrive by this way.

Observations of a New Comet, made at Paris in the Royal Observatory by Signor Cassini.

Here now appears a Comet, which seems to be near the end of his Appearance, and which might have been seen above a month since, if the weather had been favourable. But he being very small, and having been a long while observed by the beams of the Sun, to which he was nigh, and afterwards by the Moon, which was greatly advanced in her light, besides that the Heavens in these parts have often been over-cast, we have not observed him but lately.

The Mathematicians of *la Flesche* perceived him from the 16 of March, and gave us here at *Paris* the first notice of it. Those of the College of *Clermont* being advertised of it, saw him the 25th of the same month. And upon notice given of it to the *R. Academy of the Sciences* by *P. Pardies*, Professor of the Mathematicks in the College of *Clermont*, Signor *Cassini* hath ever since been observing him as much as the weather did permit

March 26.h.7 $\frac{1}{2}$. in the evening, he saw him between the Head of *Medusa* and the *Pleiades*; without a Telescope he appeared no otherwise than a Star of the third magnitude. He appeared bigger by Telescopes, and surpassed much the Stars of the first magnitude; but he was very dark, as if it had been nothing but a small whitish cloud, and we could hardly perceive him, when we held a light to the threds of our Telescopes applied to the instruments, instead of *Sights*, for to observe with greater preciseness.

His *Head*, seen with a Telescope of 17 foot, appeared almost round; but it was well defined, and distinguish't from the mistiness, which formed a kind of chevelure, wherewith it was encompassed; and even the middle was a little confused, and seemed to have inequalities, as are seen in clouds.

The *Tayl*, which is principally that which distinguisheth Comets from Stars, was almost imperceptible; yet by the Telescope it was seen turned opposite to the Sun, and it appeared of the length of two diameters of the Head or thereabout: For it was not easie, to measure it precisely, because being thinner according as it was farther from the Head, its extremity was insensibly lost. And so the whole Comet, Head, Tail, and Chevelure taken altogether, took up no more than 3 or 4 minutes of a degree.

H. 7.48'. he was in a streight line with the *Lucida* in the Head of *Meduse*, and with the most Occidental one of the *Pleiades*; and above the two clearest Stars of the Southern foot of *Perseus*; so that a streight line, drawn through these two Stars, did almost touch the Southern extremity of his Chevelure. This place of the Comet, transferred upon the Map of the Fixt Stars, fell precisely enough upon 23°.25'. of the sign of *Taurus*, in 14. degrees of Northern Latitude. Mean time, we were fain to content our selves with determining after this manner the place of the Comet, because of the difficulty we found to see him by the Instruments, when the light was held to them, as was said above.

With a Telescope of 3 foot, we saw near the Comet two small Stars, distant one diameter of the Sun from one another, which stars are not in the Catalogues. The Comet was in a manner between those two stars, and little by little he approached to the streight line, drawn from the one to the other. Signor *Cassini* waited the time of its being precisely in this streight line; which hapned at h.9.15': and then he found, that he was not exactly in the midst of these two stars, and that his center was a little nigher to that, which was west-ward: But h.9.33'. he was equally distant from them.

them both. This Observation was made on purpose to know the *parallax* of the Comet, if happily some other Observer shall have observed him in a remote Country: whence it may be judged, how far he was distant from the Earth. It was taken notice of, that from h. 8. 5". of the evening, until h. 10. 26'. he made, in respect of these two stars, an oblique motion sensible enough, going from North to South in the same time that he advanced from West to East.

Besides these two Stars, there were on the North of the Comet three other small ones, equally distant from one another, and placed in a streight line; and West-ward we saw a fourth beneath the Head of the Comet, from which she was distant about two diameters of the Comet. These 4 last Stars were so small, that we could not see them, even with a three foot Telescope; but we easily distinguish't them with one of 17 feet.

The Clouds hid the Comet about h. 10. at night, and they also kept us from seeing him the next night of March 27.

March 28. h. 7. 42'. in the evening the Comet was distant from the less bright star of the Southern foot of *Persæus*, no more than about 24'. westward. He had almost the same Latitude with this Star; so that he was precisely enough at 26. deg. 8'. of the sign of *Taurus*, and in the latit. of 12 deg. 8'. We tryed to take the distance of the Comet to the most remote fixt stars; but we found great difficulty in it: for we saw the Comet not distinctly enough by the Telescopes applied to the Instruments, when we held a light to the threads; and besides, there was a very rough wind, which did exceedingly discommode the Observers.

Yet notwithstanding, h. 8. 14'. we took, as well as we could, the distance of the Comet to the Star in the Eye of *Taurus* called *Aldebaran*, and we found, that this distance was of 19. deg. 38': And h. 8. 29'. the distance of the Comet to the Star, called *Capella*, was found to be of 22. deg. 32'. When we were preparing our selves to verifie these distances, the clouds covering the heavens interrupted the observation.

The same evening, when we beheld the Comet with Telescopes, we saw about his head a chevelure of an almost equal length, without being able clearly to distinguish his tail opposite to the Sun. 'Tis true, that the Air was not clear enough, and even at the place of the Comet there were some small clouds.

March 29. we could not observe, because the Sky was wholly over-cast.

March 30. h. 9. 35'. at night, the Comet seen without a Telescope appeared no otherwise than a Star of the 4th magnitude: through the Telescope he exceeded even those of the first; but he was very dark, and in what manner soever we looked upon him, we could observe almost no tail at all of him. He had passed one degree and an half beneath the *Lucida* of the Southern foot of *Perseus*; so that this star was exactly in the midst of the Comet and the little star of the leg of *Perseus*, marked α by *Bayerus*, which then we saw not but by a Telescope. A straight line, drawn from one of these stars to the other, did almost touch the Southern limb of the Comet, which being transferred upon the Map of the Fixt Stars, fell upon 28 deg. and 45'. of *Taurus*, in the Northern latit. of 9. deg. 56'.

H. 9. 45'. Signor *Cassini* compared the Comet with the less bright Star of the Southern foot of *Perseus*, near which he had been *March 28*; and he found, that the Western limb of the Comet touched a straight line, drawn through this less bright star of *Perseus*'s Southern foot, and through the most Northern of the Head of *Taurus*; but that he was already got somewhat nearer to the latter. This made him judge, that the Comet, which had left, on the North-side, all the Stars of the Southern foot of *Perseus*, would in the progress of his course leave, on the South-side, all the most Northern stars of the head of *Taurus*.

March 31. h. 8 in the evening, the Comet was in a direct line with the *Lucida* in the foot of *Perseus*, and with the most Northern in the Head of *Taurus*; but he was more than twice as much remoter from the first than the other, and being transferred upon the Map of the fixt stars, he was found at 15 minutes from *Gemini*, in the latit. of 8 deg. 49'. During the whole time that we could observe him this night, (which was till 10 a clock,) he quitted not this straight line, which was almost parallel to the horizon: notwithstanding that his own particular motion should raise him a little above it; as the parallax, on the contrary, should sink him beneath it in approaching to the horizon. It may be, there was a compensation made of these two contrary motions: possibly also the effect of both was not sensible; which ought to be examined. If it be found, that in some remote quarters the same observation have been made, the *parallax* will be determined by comparing the Observations.

April 1. the Comet could not be seen without a Telescope, because the Moon, being very near it, hid him from our sight. But
with

with a Telescope only of one foot we discerned him easily enough, and found, that he had passed 45'. minutes beyond the most Northern star of the Head of *Taurus*, and that he must have touch't it by his Southern limb; as also that he was distant one degree and 43'. from the Star that was nearest to that toward the South. This place being transferred upon the Map of the fixt stars, we found, that he was at 1. deg. and 30'. of *Gemini*, in the Northern Latit. of 7 deg. 44'.

Signor *Cassini*, having considered these two stars, observed, that the second is not less bright than the first; and yet that *Bayerus* hath not marked it, who hath made an exact enumeration of the Stars that may easily be seen with the naked eye; and that at first sight it seems, that *Tycho* hath left it out in his Catalogue. For he puts 4 stars in the place he calls *in quadrilatero cervicis*, and he speaks not of this which is the 5th, and maketh with the other four an irregular pentagone. 'Tis true, that besides these 4 stars, after he hath marked 13 others of them, he puts yet one by it self for the last, which he calls *in quadrilatero colli precedens*; as if, besides the first quadrilateral, there were yet another in the Neck of *Taurus*. Mean time there is in this place but 5 stars of the 5th magnitude, which make not a quadrilateral figure; but a pentagone, as I was just now saying.

This omission of *Bayerus*, and the denomination, which *Tycho* useth to denote these Stars, which suits not with the number nor the configuration that now appears, do administer cause to doubt, whether the Star in question be not one of those that appear from time to time; as there are two in the constellation of the *Swan*, and another in the neck of the *Whale*. We shall particularly take heed of this place of the Heavens, to clear up this doubt.

April 2. h. 8. in the even, Signor *Cassini*, having observed the Comet with a Telescope of one foot, which discovered 5 degrees, found, that he was two degrees and an half distant from the most Northern star of *Taurus*; and one degree from the star of the Ear, marked ϕ by *Bayerus*, and by *Tycho* called *sequentis lateris Borea*.

Two lines drawn from the most Northern star of *Taurus*, one to the Comet, the other to the Star that is wanting in *Bayerus*, made a right angle; and the distance of the Comet to this angle was double to that, which is between these two Stars. This place transferred upon the Map of the fixed Stars, fell on 2 degrees and 48'. of *Gemini*, in the Northern latit. of 6. deg. and 40'.

H. 6. 50'. The line drawn through the horns of the Moon pass'd through the Star, that is at the point of the Northern horn of *Taurus*, and the distance of this Star to the Northern horn of the γ was by a Minut greater than the Semi-diameter of the Moon.

April. 3. The Sky was so cover'd, that we despair'd to observe the Comet that night: yet notwithstanding the Clouds being somewhat dispell'd h. 9. we saw him with one foot Telescope. He had pass'd over the upper Star of the Ear of *Taurus*, and he made with this Star the *basis* of an *Isoceles* triangle, on the top whereof was the inferiour Star of the Ear. The two sides of this Triangle were two times and an half bigger than the *basis*; so that the Comet was at four degrees from the sign of *Gemini*, in the Northern Latit. of 5 degr. and 38'. The clouds being almost presently return'd, we could observe no further.

April 4. The Heaven was constantly cover'd, so that we could make no Observation at all.

April. 5. h. 8. at even, the Comet had pass'd the Northern Ear of *Taurus*, and was equally distant from the upper Star of the Northern Ear, and from that which was on the front of *Taurus*. He was also as distant from the inferior Star of the Ear of *Taurus*, as this Star is from the next West-ward, by Tycho call'd *inferior precedentis lateris quadrilateris*; and a streight line, drawn through the Comet and the upper Star of the Ear, made an almost right angle with an other line, drawn from the Comet to the inferior of the two small stars, that are above the Eye of *Taurus*. This place being carried over to the Map of the fixt stars, the Comet was found at 6. deg. 18'. of the sign of *Gemini*, in the Northern latit. of 3. deg. 41'. He was so confused this night, that even with the 17 foot Telescope we could not exactly distinguish the Head from the Chevelure, which environed him. The whole appear'd a little bigger than the disque of *Jupiter*, seen by the same Telescope.

Apr. 6. h. 8. at even, a streight line drawn from the Comet to the star that is in the front of *Taurus*, made a right angle with an other streight line drawn from this same star to the inferiour of the two that are above the Eye: And the distance of this later star to that of *Taurus* was twice the distance of the same star of the front of *Taurus* to the Comet. This place being transferr'd upon the Map of the fixt stars, the Comet was found at 7. deg. 25' of *Gemini*, in the Northern latit. of 2. deg. 45'. H. 9. 6'. we saw

on the side of the Comet a star sufficiently clear, which was not further distant from him, than a little more than the diameter of the Comet, and that was at the same height of the Horizon: which may serve to determine the *parallax*, if the same observation be made elsewhere.

April. 7. h. 9. in the evening, the Comet was equally distant from the inferior star of the Northren Ear of *Taurus*, and from the superior of the root of the Northren horn. He was also as far distant from this latter star, as this star is from that of the front. This place, being carried over to the Map of the fixt stars, fell on 8. degrees and 30'. of *Gemini*, in the Northren latit. of 1. degree and 56'. As we were preparing to observe with the great Telescope, the Heaven was clouded over.

April. 8. 9. and 10. we could make no observation at all, because of the constant dark weather.

Signor Cassini's reflections on the foregoing Observations.

All the places of the Comet, that we have observed till now, fall into a line little differing from an Arch of a great Circle, which cuts the Ecliptique in the 10th. deg. 45'. of *Gemini*, and which consequently hath its greatest latitude in the 10th. degree and 45'. of *Pisces*; which latitude is between 39. and 40. deg Nord-ward. The same Circle cuts the *Equator* at 101. degrees of the Vernal Section East-ward, and its greatest declination from the *Equator* Nord-ward is of $38\frac{1}{2}$ degrees.

Whence it follows, that the Comet at the time of his greatest Declination, wherein it may have stay'd a considerable time, hath touch'd the horizon of those that are in the latitude of $51\frac{1}{2}$ degrees; the parallel of whom passeth through the lower part of *England*, and through *Zealand*, *Westphalia*, *Saxony*, *Poland* &c: And that he hath remain'd at that time all night and all day above the horizon of the most Northern people; as are those of the upper part of *England*, *Holland*, *Pomerania*, &c. But that he hath pass'd through the Zenith of the lower part of *Spain*, and through *Sardinia*, *Calabria*, *Chio*, *Smyrna*, &c; yet without having been perceived in those places, because he there pass'd in the day-time.

Since we could not see this Comet but about the end of *March*, we have made use of our method explained in the Theory of the Comet of the year 1665, to find the places whereabout this Comet hath been during the moneth of *March*, in the Hypothesis of the equal rectiline. I motion, which serveth to
repr.

represent the places of Comets for some time of their apparition, but not for the whole time: as we have shew'd in that Theory.

Having therefore chosen two of our first Observations, (because the latter are not so proper for this purpose,) and having taken a Mean between the first Observations of the Mathematicians of *la Fleſche*, we have found by this method, that the Comet had been in his Perigee the 12th. of March at 8 a clock in the morning: that in that time, which is that of his greatest apparent celerity, he made about 2. deg. 32'. a day in the great Circle of his *apparent* motion, and $\frac{444}{10000}$ of his perigee-distance in the line of his *equal* motion: that he was in his greatest Declination the 11th. and 12th. of March; and that at that time he pass'd through the inferiour Meridian at about two a clock after midnight. Wherefore, if the weather hath been favourable, he must have been observ'd by Mr. *Hevelius*, who hath seen him, witness his Letter, from the 6th. of March; * at which time he was in perigee and made the biggest shew.

* See No. 81.

P. 4017.

If we have rightly determin'd his Perigee, and that the *Hypothesis* of the equality of his motion be just for that time, nor he hath begun to appear but when he was sufficiently nigh to the Earth; then he hath been visible since the middle of *February*, at which time he was as far distant from his perigee by approaching to the Earth, as he is at the present by receding from it. He must then have been at the extremity of the Southern wing of the *Swan*, and arriv'd at the Southern foot of *Pegasus* on the 23th. of *February*, of the same bigness that he was seen to be of, *March* 28. He must have arrived at the Stars of the Northern Arm of *Andromeda*, *March* the 9th; at those of her Girdle, the 12th. when he was in his Perigee, and in his greatest declination; to her Southern Legg, *March* 15th; between her Southern Legg and the Triangle, *March* 18th. very near as he was observ'd at *la Fleſche*; and under the head of *Medusa*, *March* 25th. The dayes ensuing he must have arriv'd at the places marked in our first Observations: But in the last, he hath been swifter than this *Hypothesis* will bear. To represent these latter Observations, the Line of the motion ought to have been made curve, as we did for the end of the apparent motion of the Comet of 1665, with this difference, that instead of that lines being convex in re-

gard of the Earth, because the motion was retrograde, *this* was to be made Concave towards the Earth; suitable to what hath been said in the same Theory, because that the motion of this Comet is direct.

According to this *Hypothesis*, those last daies, that the Clouds hindred us from seeing this Comet, he must have continued his course towards the root of the Southern horn of *Taurus*, and having pass'd the Ecliptique between the 9th and 10th of *April*, he must pass on the top of *Orion's* head the 20th; over his Arm the 24th; and at the end of this month he will be in the *Milky Way*. But it will be difficult hence forward to find him, because of his smallness, and the light of the Moon.

'Tis a thing worth observing, that this Comet keeps his course almost like that of the 2^d Comet of 1665, and of another of 1577 observ'd by *Tycho*. For they have pass'd through almost the same Constellations; though this be more inclined Nord-ward, and cut the Ecliptique five or six degrees more forward than that of 1665. So that it seems, that in this place of the Heavens there is, as 'twere, a *Zodiaque* for Comets.

An Account of some Books.

I. *De RESISTENTIA SOLIDORUM* Alexan. Marchetti, in *Pisana Academia Phil. Prof. Excusum Florentiæ 1665 in thin 4^o*.

THis book came not long since to my hands: It had been promised some years before under the Title of *Galileus ampliatas*. But the Author now follows not the Steps of *Galileus*, but demonstrates all his Propositions another way; building all upon this ground: *Momenta Graviorum proportionem habent compositam ex proportionibus ponderum & longitudinum*: which is his first Proportion. This Book being but small, and the subject admitting of enlargement, the Author promiseth a larger Treatise of the same.

II. *Tabula numerorum QUADRATORUM decies millium, una cum ipsorum LATERIBUS ab Unitate incipientibus, & ordine naturali usque ad 10000. progredientibus.* Londini, 1672.

A Table of ten thousand Square numbers, namely of all the Square Numbers between 0 and 100 millions; and of their *Sides* or *Roots*: Which are all the whole Numbers between 0 and ten thousand: 8 sheets in fol.

The Concinnity of 10, 8 or 7 Centuries in each opening, may so please some Reader's eye as to invite him to continue the Table

Table to 100 thousand Squares, placed in the same order. But Arithmeticians will see divers advantages, which would have been lost, if there had been more or fewer lines in a page; or if the Centuries had not stood entire in every aperture.

The two last pages are sufficiently contained in p. 30. which preceeds them, if men were acquainted with the compendious way of writing in *Cribris*. That fair edition of *Aratus*, printed this year in *Oxford*, adjoins some fragments of *Eratosthenes* (who dyed almost 1900 yeares ago.) Among the rest, there is the beginning of his Arithmetical *νόμος* of odd numbers, to shew, which of them are incomposit &c. The loss of that *cribrum* was abundantly supplied by the Table of incomposit numbers, printed at *London* for Mr. *Pitt*. 1668; as this Table is.

Those 3 last pages have a Curiosity, perhaps not seen before; viz. an accurate enumeration of all the *Endings* of numbers truly Square. Those *Endings* in one figure are six; in two figures, are 22; in three figures, are 159; in 4. figures, are 144: which, being here set down in their natural order, stand there ready to discover many long given numbers not to be Square; which otherwise could not have been perceived to be such till after extraction.

But they also give an occasion to transcribe here the three last lines of the last page, which are these.

“Having the two three or four last figures of any Square number,
“to exhibit as many of the last figures of its side, is a new Question;
“to which the just answers are manifold and not obvious. A
“particular Account of them is ready for the press, when it shall be desired.

In the mean time, the Publisher, having seen the said Account in the hands of the Author (Doctor *Pell*,) is able, for the clearing of those words [*the just answers are manifold*] to add thus much:

When the Question is concerning the 22 Combinations, 20 of them have 4 Answers a peice; 50 of them have, each of them, 10 Answers.

When the Question is concerning the 159 Ternions; 100 of them have 4 Answers a peice: 50 of them have, each, 8 Answers; Two of them have, each, ten Answers; Five of them, have each, 20 Answers; Two have, each of them, 40 Answers.

When

When the Question is concerning the 1044 Quaternions ; 1000 of them have 8 Answers a peice ; 40 of them have, each, 40 Answers ; four of them have, each, 100 Answers :

As it is hoped, will shortly appear in print ; that so the Excellent Author may proceed to publish his higher and more plausible superstructures.

III. Regneri de Graaf. de *MULIERUM ORGANIS GENERATIONI INSERVIENTIBUS* Tractatus novus. Lugduni Batavorum, 1672 in 8°.

WHat this Inquisitive and Industrious Anatomist had formerly promised touching this Subject (intimated N°. 34. p. 663. and N°. 79. p. 3056. 3057.) he now amply performeth in this Treatise, which appears to be written upon long search and much examination, and is illustrated with many very curious and accurate Schemes.

The main Design of the Book is, to make it out what the Author as well, as *Van Horn*, *Steno*, *Swammerdam*, and others have given out concerning the Manner of Generation in Animals call'd *Viviparous* ; viz. that they, no less than the *Oviparous*, have *Ovaria* containing many Eggs ; and that those Eggs are after the same manner rendred prolifick, and come to the *Uterus*, as they do in Fowl : which he saith will be found more than probable to those, that shall have well examin'd the Genitals of *Oviparous* creatures ; in regard that, as the extremity of the *Oviductus* or Egg-channel ends in a membranous expansion in Birds ; so the *Tubæ Fallopianæ* do end likewise in *Quadrupeds*. And as the same *Oviductus* in Birds receiveth the Eggs falling from their buds ; so the said dilated *Tubæ* in *Quadrupeds* do receive the Eggs expell'd out of the Baggs. Which that it may be the better clear'd up, he observeth.

1. *Ova hæc in testibus generari ac perfici, eodem modo quo vitelli in Avium ovariiis solent ; quatenus scil. per arterias præparantes sanguis ad testes affluens, in membranosa illorum substantia materiam iis generandis ac nutriendis relinquit.*

2. *Ova è testibus expelli, quoties masculino semine irradiata, brevi post coitum sæcundum, inter eorum tunicas, glandulosa quædam substantia excrecit, quæ Ovum tamdiu comprimit, donec per papillam, in extrema folliculi superficie conspicuam, erumpat ; idque vel citius vel tardius, prout animalia longiori aut breviori tempore uterum gerunt.*

3. *Ova*

3. Ova hac ratione e testibus propulsa necessario in Abdominis cavum esse delapsura, nisi Tubæ Fallopiæ inexplicabili, at visibili tamen, modo ova illa exciperent, & ad uterum debeberent: Visibilem dicit, cum sæpius id conspexisse se, & indies se demonstrare posse affirmet.

Whereunto he adds the changes, which those Eggs daily undergo in utero: All which things coming to pass in Cows, Ewes, and other Animals, frequently dissected by him, he concludeth, that Generation in Women also is made after the same manner, quippe quæ ova in testibus, & tubas utero annexas, uti bruta animantia, obtineant.

Mean time, he would not have any one phancy, that the Eggs in Quadrupeds and Women are invested with a hard shell: that being not essential to an Egg, and there being more sorts of Eggs that have no such hard shell, than that have it; as of Fishes, Frogs, Serpents, &c.

Nec putare nos velit, in Mulieribus & cæteris Viviparis, isto quo in Gallinis modo, per unum alterumve diem Mari commissis, omnia omnino Ova fecunda reddi; cum ne quidem in omni Avium genere id fieri certum sit, in quarum aliis duo, in aliis tria, in aliis quatuor, in nonnullis decem & plura Ova simul fecundentur & ab iis excludantur. Mulieres verò, quanquam & ipse plura in Ovaris ova contineant, plarumque tamen in nostris regionibus unum tantum Ovum, masculino semine irradiatum, e testibus in uterum expellant; quamquam & plura interdum eodem simul coitu irrorari citra miraculum possint: cuius rei multa apud Casp Bauhinum l. 1. de Hermaphr. c. 8. exempla legantur; ubi nunc tres, nunc quinque, nunc decem & plures fœtus uno partu editos reperies; quod canibus, fœtibus, cuniculis &c. perquam familiare est. Ubi tamen notatu dignum, in istis animalibus tot. passim folliculos in testibus existere, quot fœtus aut Ova in utero, & nunquam in utero plures fœtus adesse, quàm folliculos in testibus; ita ut ex testibus solis, fœtum in utero existentium numerus dignosci possit.

But, besides the clearing of this matter and the difficulties and objections raised against it, the Author is very full and accurate, in describing the *Genitalia Mulierum* themselves.

Moreover he giveth us two curious and instructive Schemes de partibus Genitalibus Galli & Gallina, together with their Explication. And he omits not to deliver a minute description of the *Tubæ Fallopianæ mulierum*; and shews, whence it is, that by some they are esteem'd altogether and alwaies close, whereas they are at certain times really open, though the hole of their extremity be very narrow; p. 246. He rejects the (commonly so called) *Vasa deferentia* from being fit vessels for transmitting Eggs, p. 250. as he also contradicts the assertion of those, that pretend to have found humane fœtus of no more than 3, 4. or 8. daies old after conception, p. 246.

* See Numb. 81.
p. 4021.

Further he informs us, How an Egg is by degrees changed in utero; how it is nourished and augmented there from time to time; and in what order each part is perfected &c. Concerning which, the Reader will probably receive in a short time some discoveries, made, and lately

lately imparted to the *Royal Society*, by Signor *Malpighi*, an Italian, and Dr. *Croon* an English phylitian, both Fellows of that Society. He concludeth all with an excellent Chapter, treating of the Generation of *Rabbits*, and thereby confirming all the main parts of his former doctrine.

IV. *Discours de la CONNOISSANCE des BESTES*, par le P. Ignace Gaston Pardies, S. J. A Paris 1672. in 12°.

THE learn'd Author of this Book examines therein the Opinion of those, that esteem Beasts to be meer Engins without any perception and Knowledge. In the doing of which, he represents at large and to advantage what hath been and may be alledged in favour of that doctrine; that so, when he shall be found by the Teachers of it not to be of their sentiment, they may not Judge him to be a Dissenter at least for want of having considered their reasons.

After he hath spent the greatest part of his discourse in urging the arguments for the sole Mechanical Contrivance of the Structure and Operations of Beasts; and interspersed the discussion of the Opinion of the other extreme, which adscribes Reason to them: He declares at last his sense of this whole matter, and endeavours to prove, That Beasts, though they have not any Intellectual, yet they have a Sensible knowledg; or, though they have not such a perception that essentially carrieth with it a reflection upon it self; yet they have a simple apprehension of Objects without that reflexion. So that he esteems, that from this distinction all the difficulties, that have been propos'd, will vanish; and that the reasons, alledged to the contrary, proove indeed, that Beasts have no Spiritual knowledge, but not at all, that they have no Sensible one. For the particulars, whereby this is endeavoured to be made out, we refer the Reader to the Book itself.

Advertisement.

A short Essay Printed in half a sheet of Paper, wherein Rules are laid down, directing, how to divide a Period into sentences; with what Points the Sentences shall be distinguished, and how to read those Sentences Grammatically; more distinct than what has been formerly done: Very useful for the clearness of any discourse, and for expedit and distinct reading. By M. Lewis: Sold by Thomas Parkhurst at the Bible and Crown in Cheapside, and M. Milion, at the Bible in Fleetstreet.

ERRATA in N°. 81, P. 4011. l. 17. (=DO). l. 26. 2 fv³. ibid. pro 5² leg. s². l. 29. pro, alia VC leg. aliâve. p. 4012. l. 10. cæterisque l. 12. n v h x. l. 13. $\frac{v h = 52}{n 12 - v h x} n x$ l. 14. $\frac{s^2 u}{r^2 - r x}$ p. 4014. l. 14. post Va, add, & æqualiter accelerato secundum AV vel Ta. l. 19. & completo. l. 25. nataram. l. 27. rectis Tv. l. 31. VF. p. 4015. l. 12. AC. æE = $\frac{2}{9} r$. p. 4016. l. 1. CM. CS :: l. 12. conveniat. l. 14. accommodandus.

L O N D O N,
Printed for John Martyn, Printer to the Royal Society. 1672.

PHILOSOPHICAL TRANSACTIONS.

May 20. 1672.

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Some Considerations of Mr. Isaac Newton upon part of a Letter of M. de Bercé, concerning his Reflecting Telescope pretended to be improv'd by M. Cassegrain. Some Experiments proposed in relation to the same Mr. Newtons Theory of Light; together with the Observations by him made thereon. An Account communicated by Mr. Lister, of a Stone cut out from under the Tongue of a Man. An Extract of a Letter of the same, concerning animated Horse-hairs. Some Observations, made by Signor Thomas Cornelio, of Persons pretending to be stung by Tarantulas. An Account of the Aponensian Baths in Italy, by John Dodington Esquire. Reflexions made by P. Lana upon an Observation relating to the formation of Crystals. A Relation of an Inland-Sea near Danzick, yeilding a green Substance which causeth certain Death; by Mr. Kirkby. An Account of some Books. I. de ANIMA BRUTORUM, Exercitationes duæ, Auth. Thomas Willis M.D. &c. II. Suite des nouvelles Experiences sur la VILPERE; par Moyse Charas. III. The CHIRURGICAL and ANATOMICAL Works of Paul Barbette M.D; together with a Treatise of the Plague. IV. The AMERICAN PHYSITIAN. by W. Hughes.

R r r r

Mr. Isaac

Mr. Isaac Newton's Considerations upon part of a Letter of Monsieur de Bercé printed in the Eight French Memoire, concerning the Cata-drioptrical Telescope, pretended to be improv'd and refined by M. Cassegrain.

That the Reader may be enabled the better to Judge of the whole, by comparing together the contrivances both of Mr. Newton and Mr. Cassegrain; it will be necessary, to borrow from the said French Memoire what is there said concerning them: which is as followes.

I Send you (saith M. de Bercé to the Publisher of the *Mémoire*,) the Copy of the Letter, which M. Cassegrain hath written to me concerning the proportions of Sr. Samuel Morelands Trumpet. And as for the Telescope of Mr. Newton it hath as much surpris'd me, as the same Person, that hath found out the proportions of the Trumpet. For 'tis now about three months, that that person communicated to me the figure of a Telescope, which was almost like it, and which he had invented; but which I look upon as more witty. I shall here give you the description of it in short.

ABCD. is a strong Tube, in the bottom of which there is a great concave *Speculum* *CD*, pierced in the middle *E*.

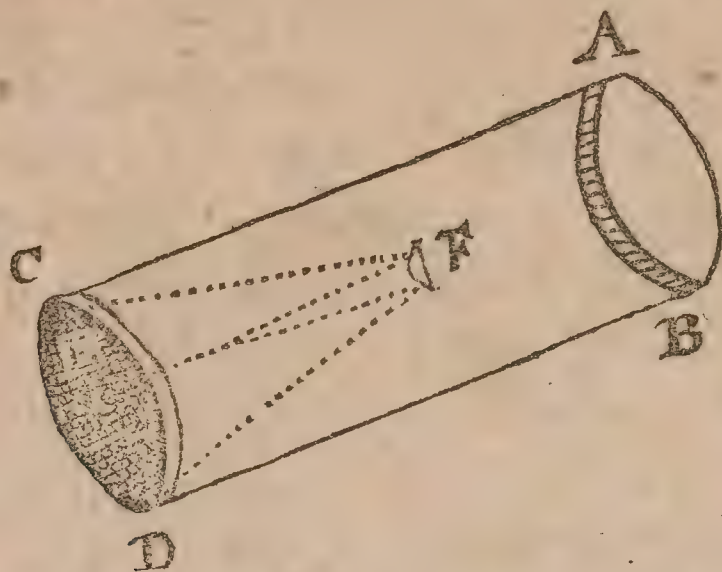
F. is a convex *Speculum*, so disposed, as to its convexity, that it reflects the *Species*, which it receives from the great *Speculum*, towards the hole *E*, where is an Eye-glass, which one looketh through.

The advantage, which I find in this Instrument above that of Mr. Newton, is first, that the mouth or aperture *AB* of the Tube may be of what bigness you please; and consequently you may have many more rays upon the Concave *Speculum*, than upon that, of which you have given us the description.

2. The reflexion of the rays will be very natural, since it will be made upon the *axis* it self, and therefore more vivid.
3. The vision of it will be so much the more pleasing, in that you shall not be incommoded by the great light, by reason of the bottom *CD*, which hideth the whole face. Besides that

you'l

you'll have less difficulty in discovering the Objects, than in that of Mr. Newtons.



So far this French Author. To which we shall now subjoin the Considerations of Mr. Newton, as we received them from him in a Letter, written from Cambridge May 4th 1672, as follows.

S I R

I Should be very glad to meet with any improvement of the Catadioptrical Telescope; but that design of it, which (as you informe me) Mr. *Casségrain* hath communicated 3 months since, and is now printed in one of the French *Memoires*, I fear will not answer Expectation. For, when I first applied myself to try the effects of Reflexions, Mr. *Gregory's Optica Promota* (printed in the year 1663) being fallen into my hands, where there is an Instrument (described pag. 94) like that of Monsieur *Casségrain's* with a hole in the midst of the Object-Metal to transmit the Light to an Eye-glass placed behind it; I had thence an occasion of considering that sort of constructions, and found their disadvantages so great, that I saw it necessary, before I attempted any thing in the Practique, to alter the design of them, and place the Eye glass at the side of the Tube rather than at the middle.

The disadvantages of it you will understand by these particulars. 1. There will be more light lost in the Metal by reflexion from the little convex *speculum*, than from the Oval plane. For, it is an obvious observation, that Light is most copiously reflected from any substance when incident most obliquely. 2 The convex *Speculum* will not reflect the rays so truly as the oval plane, unless it be of an Hyperbolique figure; which is incomparably more difficult to forme than a plane; and if tru-

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ly formed, yet would only reflect those rays truly, which respect the *axis*. 3. The errors of the said convex will be much augmented by the too great distance, through which the rays, reflected from it, must pass before their arrival at the Eye-glass. For which reason I find it convenient to make the Tube no wider than is necessary, that the Eye glass be placed as near to the Oval plane, as is possible, without obstructing any useful light in its passage to the object metal. 4. The errors of the object-metal will be more augmented by reflexion from the convex than from the plane, because of the inclination or deflexion of the convex on all sides from the points, on which every ray ought to be incident. 5. For these reasons there is requisite an extraordinary exactness in the figure of the little convex, whereas I find by experience, that it is much more difficult to communicate an exact figure to such small pieces of Metal, than to those that are greater. 6. Because the errors at the perimeter of the concave Object-Metal, caused by the Sphericalness of its figure, are much augmented by the convex, it will not with distinctness bear so large an aperture, as in the other construction. 7. By reason that the little convex conduces very much to the magnifying virtue of the instrument, which the Oval plane doth not, it will magnify much more in proportion to the Sphere, on which the great concave is ground, than in the other design; And so magnifying Objects much more than it ought to do in proportion to its aperture, it must represent them very obscure and dark; and not only so, but also confused by reason of its being overcharged. Nor is there any convenient remedy for this. For, if the little convex be made of a larger Sphere, that will cause a greater inconvenience by intercepting too many of the best rayes; or, if the Charge of the Eye-glass be made so much shallower as is necessary, the angle of vision will thereby become so little, that it will be very difficult and troublesome to find an object, and of that object, when found, there will be but a very small part seen at once.

By this you may perceive, that the three advantages, which Monsieur *Casségrain* propounds to himself, are rather disadvantages. For, according to his design, the aperture of the instrument

instrument will be but small, the object dark and confused, and also difficult to be found. Nor do I see, why the reflexion is more upon the same *axis*, and so more natural in one case than in the other: since the *axis* it self is reflected towards the Eye by the Oval plain; and the Eye may be defended from external light as well at the side, as at the bottome of the Tube.

You see therefore, that the advantages of this design are none, but the disadvantages so great and unavoidable, that I fear it will never be put in practise with good effect. And when I consider, that by reason of its resemblance with other Telescopes it is something more obvious than the other construction; I am apt to believe, that those, who have attempted any thing in Catoptricks, have ever tryed it in the first place, and that their bad success in that attempt hath been the cause, why nothing hath been done in reflexions. For, Mr. Gregory, speaking of these instruments in the aforesaid book pag 95, sayeth; *De mechanica horum speculorum & lentium, ab aliis frustra tentatâ, ego in mechanicis minus versatus nihil dico.* So that there have been tryals made of these Telescopes, but yet in vain. And I am informed, that about 7 or 8 years since, Mr. Gregory himself, at London, caused one of six foot to be made by Mr. Reive, which I take to have been according to the aforesaid design described in his book; because, though made by a skilful Artist, yet it was without success.

I could wish therefore, Mr. Cassgrain had tryed his design before he divulged it: But if, for further satisfaction, he please hereafter to try it, I believe the success will inform him, that such projects are of little moment till they be put in practise.

Some Experiments propos'd in relation to Mr. Newtons Theory of light, printed in Numb. 80; together with the Observations made thereupon by the Author of that Theory; communicated in a Letter of his from Cambridge, April 13. 1672.

I. **T**O contract the beams of the Sun without the hole of the window, and to place the prism between the focus of the *Lens* and the hole, spoken of in M. Newtons theory of light,

II. To

II. To cover over both Ends of the Prism with paper at several distances from the middle ; or with moveable rings, to see, how that will vary or divide the length of the figure, insisted upon in the said Theory.

III. To move the Prism so , as the End may turn about the middle being steady.

IV. To move the prism by shoving it, till first the one side, than the middle, than the other side pass over the hole, observing the same Parallelism.

The Observations, made upon these proposals.

I Suppose the design of the Proposer of these Experiments is, to have their events expressed , with such observations as may occur concerning them. 1. Touching the *first*, I have observ'd, that the Solar image falling on a paper placed at the *focus* of the *Lens* , was by the interposed Prism drawn out in length proportional to the Prism's reflexion or distance from that *focus*. And the chief observable here, which I remember, was, that the Streight edges of the oblong image were distincter than they would have been without the *Lens*.

Considering that the rays coming from the Planet *Venus* are much less inclined one to another , than those , which come from the opposite parts of the Sun's disque ; I once tryed an experiment or two with *her* light. And to make it sufficiently strong, I found it necessary to collect it first by a broad *lens*, and then interposing a Prism between the *lens* and its *focus* at such distance, that all the light might pass through the Prism; I found the *focus*, which before appeared like a lucid point, to be drawn out into a long splendid line by the Prism's reflexion.

I have sometimes designed to try, how a fixt Star, seen through a long Telescope, would appear by interposing a Prism between the Telescope and my eye. But by the appearance of *Venus*, viewed with my naked eye through a Prism, I preface the event.

2. Concerning the *second* experiment, I have occasionally observed, that by covering both ends of the Prism with Paper at several distances from the middle, the breadth of the Solar image will be increased or diminished as much , as is the aperture

ture of the Prism without any variation of the length: Or, if the aperture be augmented on all sides, the image on all sides will be so much and no more augmented.

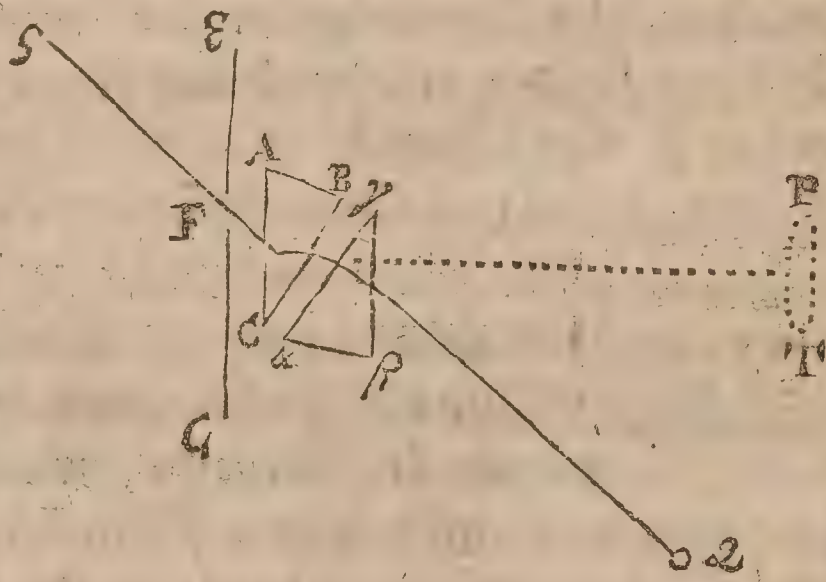
3. Of the *third* experiment I have occasion to speak in my answer to another person; where you'll find the effects of two Prisms in all cross positions of one to another described. But if one Prism alone be turned about, the coloured image will only be translated from place to place, describing a circle or some other Conick Section on the wall, on which it is projected, without suffering any alteration in its shape, unless such as may arise from the obliquity of the wall or casual change of the Prisms obliquity to the Sun's rays.

4. The effect of the *fourth* experiment I have already insinuated telling you (in pag. 3076 of the *Transactions*) that Light, passing through parts of the Prism of divers thickneses, did still exhibit the same Phænomena.

Note, that the long *axes* of the two Prisms in the experiment described in the said pag. 3076 of the *Transactions*, were parallel one to another. And for the rest of their position, you will best apprehend it

by this Scheme;

where let EG design the window; F the hole in it, through which the light arrives at the Prisms; ABC the *first* Prism, which refracts the light towards PT, painting there the colour in an oblong



form; and *aγ* the *second* Prism, which refracts back again the rays to Q where the long image PT is contracted into a round one.

The plane *aγ* to BC, and *βγ* to AC, I suppose parallel, that the rays may be equally refracted contrary ways in both Prisms. And the Prisms must be placed very near to one another; For
if

if their distance be so great, that colours begin to appear in the light before its incidence on the second Prism, those colours will not be destroyed by the contrary refractions of that Prism.

These things being observed, the round image *Q* will appear of the same bigness, which it doth when both the Prisms are taken away, that the light may pass directly towards *Q* from the hole without any refraction at all. And its diameter will equal the breadth of the long image *PT*, if those images be equally distant from the Prisms.

If an accurate consideration of these refractions be designed, it is convenient, that a *Lens* be placed in the hole *F*, or immediately after the Prisms, so that its *focus* be at the image *Q* or *PT*. For, thereby the Perimeter of the image *Q* and the straight sides of the image *PT* will become much better defined than otherwise.

An Account of a Stone cut out from under the tongue of a Man; lately sent in a Letter of Mr. Listers to his Grace the Lord Archbishop of York.

May it please your Grace,

IN obedience to your Grace's Commands, I have penned the Circumstances of a not common Medical observation, viz. the Excision of a stone from under the tongue. And I here with present your Grace also with the stone its self, as I had it from the person it was taken.*

* This Stone is now in the custody of the R. Society, to whom it was presented afterwards.

As to the occasion and time of its birth, he tells me, (My Lord, you may be pleas'd to give firm Credit to every particular, that he hath answered me at your Grace's instance) it was from a winter Sea-voyage, which lasted much longer than he expected, and wherein he suffered an exceeding cold; and that, not long after his landing, he found a certain *Nodus* or hard lump in the very place whence this stone was cut. There was about 8 years betwixt its breeding and being taken away.

As to its growth, and the inconveniences thence ensuing; he further saith, that upon all fresh-cold-taking, he suffered much pain in that part especially; and yet, that cold once being over, that part was no more painful than the rest of his mouth. He adds, that towards the 7th and 8th year it did often cause sudden

sudden swellings in all the Glanduls about the mouth and throat upon the first draught of beer at meals; which yet would in a short time fall again.

Lastly, as to the particulars remarkable at the time of its being taken away, he relates; That it began its work with a sudden *vertigo*; which vertiginous disposition continued more or less from Spring 'till August; in which month, without any prævious cause save riding, the place where it was lodged suddenly swelled, and ran purulent matter at the aperture of the *ductus Whartonianus*: that it suddenly stopped of its running (which he cannot attribute to any thing but Cold,) and swelled with a great inflammation, and very great danger of choaking; it being scarce credible, what pain the party suffered in endeavouring to swallow even beer, or any liquid thing.

This extremity lasted 5 days, in all which time, the party had so vast a flux of spittle running from him, that it was not possible for him to repose his head to sleep, without wetting all the bed about him; insomuch as that it was very much questioned by some friendly visitants, whether he had not of himself, or by mistake, made use of some Mercurial medicine.

The varieties or degrees of this *spontaneous salivation* were such, that he urged me not to omit them in the relation I was to make to your Grace, as thinking them very notable.

The first day, the *saliva* ran thin and transparent, almost like water without any bubbles. The 2 day it ran frothy; it tasted salt, (which yet he is apt to think hot rather than really salt, because that day the inflammation was at the height). The 3 day it roaped exceedingly; on which day a small pin-hole brook directly over the place of the Stone and ran with purulent matter as formerly. The 4 day the *saliva* ran *insipid*, sensibly cold in the mouth; (which again confirms me in that opinion, that the former sharp taste was the effect of heat, and not the immediate quality of a salt humour;) very little frothy. The 5 day (which was the day of the incision,) it ran as on the 4th but left an extreme claminess on the teeth, insomuch that they often clave together, as though they had been joyned together with glue.

Upon the incision, which proved not wide enough, the membranes or baggs, wherein the Stone lay, came away first. As to the Stone it self, it was so hard as to endure the *forcipes* in drawing it
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forth: it was covered over with grass green matter, which soon dried, and left the stone of a whitish colour, as it is to be seen. It is but light in proportion to its bulk, weighing about 7 grains; and 'tis much of the shape of our ordinary horse-beans. There are visible impressions upon it of some Capillary and small vessels, it was bred amongst. Lastly, it is scabrous or rough, sand-like, although the substance is Tophaceous.

The Accidents accompanying the working away of this Stone, (for the incision was meerly obstetrical,) and the place of its birth give occasion to call the distemper a *Ranula*. Yet in truth this was nothing else but one of those Tumours called *Atheroma*; and therefore we will name it *lapis Atheromatis*.

An Extract of a Letter of the same Mr. Lister, written from York April 12. 1672, concerning animated Horse-hairs; rectifying a Vulgar Error.

Sir,

I Cannot discover any thing new and rare in natural Philosophy, but I must forthwith make you participate of my good fortune; and I assure you, the relation, I am about to make you, is of a thing very surprising.

It hath been credibly reported, that *Horse hairs* thrown into water will be animated; and yet I shall shew you by an unquestionable observation, that such things as are vulgarly thought animated Hairs are very Insects, nourished within the bodies of other Insects, even as *Ichneumones* are within the bodies of Caterpillars.

I will premise the particulars concerning this Animal, as I find them collected by the Industry of *Aldrovandus*, and save you the trouble of that voluminous Author.

This Insect (saith he) seems to have been unknown to the Ancients; as it is called by the moderns *seta aquatica* or *vermis setarius*, either from the most slender figure of the body; or because it is thought to be generated of an horse-hair putrifying in water. The Germans call them by a name rendred *Vituli aquatici*.

It is bred in corrupt waters; perhaps of horse-hair, for (saith *Albertus* upon his own frequent trial, as I find him quoted by *Aldrovandus*;) these hairs put into standing water, move and are animated, or, as he words it, *citant spiritum accipiunt, & moventur*.

sur. Others have thought them to have their birth from weeds hanging down from the banks into ponds and Rivers. Others from Locusts and Grasshoppers (*ex Bruchis*;) which last though it be near the matter, yet it is rejected by *Aldrovandus* himself, as the most unlikely.

They have been found in a cold and good spring, and elsewhere, (which is a wonder, saith *Aldrovandus*;) upon a leaf in a Garden. And this, which was there found, was 5 or 6 fingers-breadth long; the thickness of a bristle Horse-hair, with a duskish back, and a white belly; and the tail on every side white.

I saw (saith *Aldrovandus*) a black one thicker than the whitish one. Other Authors otherwise describe them, as *Bertrutius*, *Albertus*, &c. Some affirming them to have been a cubit long; others, two cubits, others, 9 inches long at the least: that they are white of colour, and so hard as scarce to be crushed with ones foot: to be every where of the same thickness: that they move not as wormes move, but *snake-like*, and knit themselves up into knots: that their skin is one continued thing without Incisures; and therefore some would exclude them from the insect-kind: that they have no head, but swim both waies, and therefore may be called *amphisbæna aquatica*: that they are poyson, drunk down into the stomach, but not venom to the touch.

And thus much out of *Aldrovandus* concerning the name of this Insect, the place of its birth and original, the place where they are to be found, its description, different species, nature, poyson &c.

Our observation is this. *April. 2.* there was thrown up out of the ground of my Garden, in digging amongst other things of this nature, a certain cole-black Beetle of a middle size, and flat shape, and which I have observed elsewhere common enough. These Beetles I dissected upon the account of some curiosity, wherein I had a mind to satisfy myself. But I was surprised to find in their swollen bellies of these *Hair-wormes*, in some three, in others but one only. These particulars we carefully noted: 1. That upon the incision they crawl'd forth of themselves. 2. That putting them into water, they lived in it many daies, and did seem to endeavour to escape by lifting up their heads out of the water, and fastning them to the side of the vessels; very plainly drawing the rest of their body forward. 3. That they cannot be

said to be *amphisbæna*, but do move forward only by the head, which is fairly distinguishable from the tail by a notable blackness. 4 That the three, I took out of the body of one Beetle, were all of a dark hair-colour with whitish bellies, somewhat thicker than hoggs bristles; but I took out of the body of another beetle one that was much thicker than the rest; much lighter coloured; and by measure just five Inches and a half long; whereas all the rest did not exceed three inches three quarters.

An Extract of a Letter, written March 5. 1672. by Dr. Thomas Cornelio, a Neapolitan Philosopher and Physician, to John Dodington Esquire, his Majesties Resident at Venice; concerning some Observations made of persons pretending to be stung by Tarantula's: English'd out of the Italian.

S I R

NOW the time approaches, that I may send you some *Tarantulas*. Mean while I shall not omit to impart unto you, what was related to me, a few daies since, by a judicious and unprejudicate person, which is; That being in the Country of *Otranto* (where those Insects are in great numbers,) there was a man, who thinking himself stung by a *Tarantula*, shew'd in his neck a small speck, about which in a very short time there arose some pimples full of a serous humour, and that, in a few hours after, that poor man was sorely afflicted with very violent symptoms, as *Syncope's*, very great agitations, giddines of the head, and vomit; but that without any inclination at all to dance, and without all desire of having any musical instruments, he miserably dyed within two daies.

The same person affirm'd to me, that all those that think themselves bitten by *Tarantula's*, (except such, as for some ends fain themselves to be so,) are for the most part young wanton girles, (whom the Italian writer calls *Dolci di sale*,) who by some particular indisposition falling into this melancholly madness, perswade themselves according to the vulgar prejudice, to have been stung by a *Tarantula*. And I remember to have observed in *Calabria* some women, who seized on by some such accidents were counted to be possess'd with the Divel; it being the common belief in that Province, that the greatest part of the evils, which afflict man-kind, proceeds from evil Spirits.

This brings to my mind a terrible evil, which often enough

is observ'd in *Calabria*, and is call'd in their language *Coccio maligno*. It ariseth on the surface of the body, in the form of a small speck, of the bignes of a lupin. It causeth some pain, and if it grow not soon red thereupon, it in a very short time certainly kills. 'Tis the common opinion of those people, that such a distemper befalls those only, that have eaten flesh of Animals dead of themselves: which opinion I can from experience affirm to be false. So it frequently falls out, that of many strange effects, we daily meet with, the true cause not being known, such an one is assigned, which is grounded upon some vulgar prejudice. And of this kind I esteem to be the vulgar belief of the cause of that distemper, which appears in those that think themselves stung by *Tarantulas*.

But why should not we rather think, that that distemper is caused by an inward disposition, like that which in some places of *Germany* is wont to produce that evil, which they call *Chorea Sti Viti*, St. Vite's dance. But of this I hope I shall soon be able to write my thoughts more fully, which will, I think, be sufficient to refute that fable of the *Tarantula*.

An Account of the Aponensian Baths near Padua; communicated by the foremention'd Inquisitive Gentleman, Mr. Dodington, in a Letter written to the Publisher from Venice March 18. 1672.

S I R,

IN the Observations and History of Nature possibly this may not be unworthy the notice. Five miles from *Padua* are the waters, call'd *Aponensia*, from a town called *Aponum*, famous in antiquity, and among others frequently mention'd by *Livy*. I will not doubt, but that Sr. I. F. and D B. two worthy members of the *R. Society* and who lived long in *Padova*, have inform'd themselves most exactly of what ever I shall be able to say on this Subject; however I do not scruple to give you a short relation of it.

The waters are actually very hot. Secondly, they are stinking. Thirdly, they yield a great deal of very fine salt; of which the natives serve themselves in their ordinary occasions. This salt is the thing, I think most considerable there. It is gather'd in this manner: The Natives, after Sun set, stir peices of wood in the water, and presently the Salt sticks to them, and comes off in small flakes, exceeding white, and very salt. This never looseth its favour. The people there, with the same water use to wash
their

their wales, to render them whiter then ordinary; which it doth even whiter than lime. Such wales conserve their saltness some few daies only, and then become insipid, even though they sweet forth a white excrescence in thin and light flakes like niter, many years after. But that Salt, which is collected from the stones, gravel and earth, by which the rivulets, descending from those Baths, do run, is without any taste of Salt; though there be no difference in the form or colour from that which is gather'd with the wooden instruments, by me mentioned. This is the Sum of what I have to say at present of this particular. If you think the matter *tanti*, I will send you a more ample description thereof, with my thoughts upon it.

Reflections made by P. Francisco Lana S. J. upon an Observation of Signor M. Antonio Castagna, Super intendent of some mines in Italy, concerning the formation of Crystals: English'd out of the XI. Venetian Giornale de Letterati.

IN the last month of September, being arrived in the *Val Sabbia* into a place call'd le *Mezzane*, where I knew that those Crystals are generated, I observ'd in a spacious round of a Meddow, seated on a hillock, some narrow places bare of all herbs, in which alone, and no where else thereabout, those Crystals are produced, being all sex-angular, both points of them terminating in a pyramidal figure, sex-angular likewise.

I was told, that they were produced from the dews, because (forsooth!) being gather'd over night, the next morning there would be found others at such a time only, when it was a serene and dewy sky; and that upon the herbs of the meddow, and without the bounds of those bare and sterile places never any Crystals were to be found; besides, that the ground having been in some places bared of all greens, and reduced to the condition of those other naked places, yet no crystals were ever seen to have been form'd there. But I, when I had examined, that in the neighbour-hood of that hill there was no mark at all of any Mines, did conclude, that it might be a plenty of nitrous steames, which might withal hinder vegetation in those places, and coagulate the Dew falling thereon. And that those exhalations were rather Nitrous, than of an other kind, I was induced to believe, because Niter is not only the natural *coagulum* of water

ter, as is manifest in artificial glaciations; but also it ever retains the above said sex-angular figure, altogether like that of those Crystals. Which may also be the very cause of the sex-angular figure in *Snow*; this being nothing else but water concentered by its natural *coagulum*, which is a nitrous exhalation. And to make it yet more manifest, that these are indeed expirations of niter, I digg'd up some of the earth, and drew a Salt from it, which had both the tast and figure of Niter; though some grains of it were of a square, others of a pyramidal, figure.

It therefore ought not to be affirm'd, that a dewy vapour is of it self able to be form'd into a solid gem; because, if that were so, such vapours being easily carried by any motion of the Air from those narrow places, and falling down in dew far from the same, Crystals would be formed in those other places; but they are only form'd there: Whence we may very probably infer, that thence are raised the exhalations, which do concrete the dew, after such a manner as the vapour or exhalation of Lead coagulates Quicksilver.

A Relation of an Inland-Sea, near Danzick, yielding at a certain season of the year a green substance, which causeth certain death; together with an Observation about white Amber: Communicated by Mr. Kirkby, in a Letter written to the Publisher from Danzick Decemb. 19, 1671.

Near a small village, call'd *Tuckum*, $2\frac{1}{2}$ German miles distant from this Citty west-ward, there is an Inland-Sea (made by the meeting of three rivolets, some springs from the adjoining hillocks, and the descending rain and snow-water,) of about half a German mile long and an eighth part of such a mile broad. It stretches NNW and SSW. About the middle of the bow on the East-side it dischargeth it self with a pretty stream; as it also doth in another place more Southerly. The soil of the ground round about seems to be sand mixt with clay. Its shore generally sandy, as is its bottom also. Its depth, where deepest, four fathoms; but for the most part but one, or one fathom and an half. 'Tis stored with wholesome and delicate Fish, as *Pearch*, *Roch*, *Eles*, &c. and famed for a small fish, much esteem'd here, and not much unlike a *Pearch*; only not so party colour'd.

red, and having a larger head proportionable to its body, call'd the Cole-pearch. The water fyweet and vvholefome; but only in the three Summer months, June, July, and Auguft, it becoms every year, during the dry weather, green in the midle vvith an hairy efflorefcence; vvhich green fubftance, being by fome violent vvind forced a fhore, and vvith the vvater drunk by any Cattel, Dog, or Poultry, caufeth certain and fudden death; whereas at the fame time, that a knowing and ingenuous perfon (vvho firft acquainted me vvith it,) fawv three dogs killed vvith it, the Horfes that vvere ridden into the vvater *beyond* the place, vvhere this green fubftance floated, drunk vvithout any hurt; and that alfo, during the fame feafon, the vvater in the freams, that flowv from it, are vvholefome. I fhall endeavour, if you defire it, to procure fome of that ftuff, and get it examin'd by a chymical analyfis.

One thing more I muft add, that the chief Fifher here inform'd me, that tvvo or three years ago fifhing in this Sea, his net brought up a confiderable large piece of vvwhite Amber, vvhich as a rarity he prefented to one of the chief Fathers of the Olive's Abby, to vvhich this Sea belongs. Novv fince this Sea is not to be fufpected to come from the Ocean, it lying fo high, and about three German Miles diftant from the Ocean; and fince alfo the neighbouring woods that bear none, but highly refinous trees, cannot be reasonably faid to furnifh fuch Amber, that conjecture, which imports that Amber is a bituminous fluid fubftance, hardned by the operations of the aqu-aerial particles upon it, may receive fome confirmation from this account.

An Account of some BOOKS.

- I. *De ANIMA BRUTORUM Exercitationes duæ, prior PHYSIOLOGICA, altera PATHOLOGICA, Auth. Thoma Willis M.D. Philos. Natur. Prof. Sidlej. Oxon. nec non Med. Coll. Lond. & Soc. Reg. Socii. Oxonii, A. 1672. in 4^o.*

What the Learned Author of this difficult Argument had heretofore promised, he now in this Book with much care performeth; which is the *Pathology of the Brain, and the Nervous kind*, explicating the Diseases that affect it, and teaching their Cures; together with some previous Physiological Considerations of the *Soule of Brutes*.

And because it may, by some, be thought somewhat paradoxical, that he assigneth to that Soul, whereby both Brutes and Men have life, sense, and local motion, not only extension, and as 'twere Organical parts, but also peculiar Diseases, and appropriate Cures; and because also he distinguishes this meerly vital and Sensitive Soul from the Rational, to which he makes it subordinate, and so maketh man a Double-soul'd Animal; he maketh it first of all his business to clear these matters, and to free them from what may seem offensive in them.

In the doing of this he denieth not the Corporeity of the Brutal Soul, esteeming, that both by considerable Arguments, and by very ample, ancient and modern, Suffrages, the same may be evinced; and besides, that its *Bipartition* is by a necessary consequence deducible from the *flammeous* Life of the *Bloud*, and the *lucid* or *Æthereal* substance of the *Animal Spirits*; both which he hath formerly asserted, and endeavoured to prove. For, if it be granted him, that the *Vital* portion of this Soul, lodging in the *Bloud*, be a kind of Fire, and the *Sensitive* part be nothing but an Aggregate of Animal Spirits, diffused all over in the Brain and Nerves; he draws this consequence, That the Soul of a Brute, co-extended to the whole Body, hath not only many and distinct, but also somewhat dissimilar, parts. And if it be objected, that the Soul of a Brute is immaterial, because it perceiveth, or is aware that it feels, Matter seeming incapable of Perception; he

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answers,

answers, That that would be very probable, if that Perception did exceed the bounds of things material, and were of a higher pitch, then what is generally ascribed to Natural Instinct, or *Idiosyncrasis*: Adding, that none is like to undertake to prove, that the Omnipotent Maker, and First Mover, and Constant Governour of all things should not be able to impress such powers upon Matter, as might be proper and sufficient to perform the functions of the Sensitive life.

And as to what he further asserts, That some people are more, yea sooner and rather sick in their Soul, than in their Body; (whereas Physicians do commonly in Schools refer the principal Seats of all Diseases to the solid parts, and the humors, and vital spirits;) in this he speaketh consonantly to his *Hypothesis*: For, since that that Soul hath a material Being co-extended to the Body, and peculiar parts, powers and affections, he rationally concludeth, that it is subject also to preternatural affections, and frequently needs the Physicians aid.

Besides, he esteems to have made it out in his *Pathology*, That the Corporeal Soul extends her Diseases not only to the Body, but also to the *Mind* or the Rational Soul, and often involves the same in her defects and perturbations.

Moreover, he thinks to have also proved from reason and authority, That there are in Man two distinct Souls, subordinately; and esteems this opinion to be so far from being Heretical or pernicious, that on the contrary he hopes, it will prove altogether Orthodox, and conducive to a good life, and a powerful confutation of Atheism.

But to the end that the Author might the better inform his Reader of the Corporeal Nature, and the *flammeous* and *lucid* parts, and the affections of the same, he found it necessary *both* to describe the vital Organs of divers Animals, by whose operation the Lamp of Life is maintained; and to represent also the Brains of those they call perfect Brutes, and of Man, discovered by him as to their inmost recesses, and their secret and smallest *ductus's*. By which manifold and comparative Anatomy, as the manifold and wonderful wisdom of the Creatour is manifested; so are by the same discovered, even in the smallest and most despicable Animals, not only mouths and limbs, but also hearts, being as 'twere so many altars and hearths to perpetuate this vital flame. Here
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the Reader will meet with very skilful and accurate Dissections of the *Silk-worm*, *Oyster*, *Lobster*, *Earth-worm*; as also of divers Brains; and *first*, of that of a *Sheep*, in a manner excarnated, to make the Medullar streaks, and its inmost fabrick to be seen: And *secondly*, of a new one of an *Humane* Brain; where, a Section being made through the *falx*, the *Corpus callosum* and the *Fornix*, and their parts displayed and orderly laid open, are exhibited the streaked bodies, as also the Optick and Orbicular prominencies, &c. That so by confronting these Brains, the vast difference of the Soul of a Brute and that of a Man may the better be shewn.

Concerning the *Pathology* of this Author, he confesseth, that in delivering the Theories of Diseases he hath relinquish'd the Old way, and produced mostly new *Hypotheses*; which being founded and establisht upon true Anatomical Observations, give a better account of the *Phænomena* of the sick, indicate more aptly the causes of symptoms, and suggest properer waies of curing them. But as to Remedies and his Therapeutical Method, though therein he doth not with others scrupulously insist in the footsteps of the Ancients; yet he rejects nothing that hath been settled by sober Authority, and by long Experience; adding thereunto many things invented by late Experience, and by Analogy. All which he hopes will prove useful both for improving Medical knowledge, and the happier curing the Diseases of the Head; which he enumerates, and discourses upon, both as a Naturalist and a Physitian.

II. *Suite des nouvelles Experiences sur la VIPERE, avec une Dissertation sur son VENIN; par Moyse Charas. A Paris 1671, in 8°.*

THis is a Sequel of Experiments, made by the skill and industry of the same, that was the Author of the Tract, entituled *Nouvelles Experiences sur la Vipere*, formerly described in *Numb. 54.* and since English'd out of French, and printed by Mr. *Martyn* at the Bell in *Pauls Church-yard*. It is made by the Author in his own defence against a Letter of Signor *Redi*, published in Italian against some Experiments of the Author's former Book, and described in *Numb. 57.* In it M. *Charas* expresseth, that he is so far from changing his opinion upon his examining

Signor *Redi*'s Letter, that he is much more confirmed in it.

The Controversie consists chiefly in this: 1. That Signor *Redi* will have the Jellow liquor contain'd in the bags of the Teeth-gum of Vipers to be the only and true seat of their Venom. 2. That this liquor is indeed not Venomous being taken at the mouth, but only when let into a wound, made either by the live Animal, or even by a dead ones teeth, thrust into ones flesh after it is dead. 3. That the same Juice drawn from a dead Viper, as well as from a live one, is alwaies venomous, if it pass into a wound and mingle with the bloud of the wounded Animal, whether it be liquid, or dried to powder. 4. That it kills generally all sorts of Animals being wounded, and receiving of this liquor into the wound. Whereas M. *Charas* asserts, 1. That the Venom of Vipers is on'y in the enraged Spirits. 2. That the Jellow liquor, as well of a live and even a much angred Viper, as of a dead one, hath no Venom at a'l in it, neither in the biting, nor when taken inwardly, nor let into a wound and mixt with the bloud, nor any other way; and consequently that it kills and infects no kinds of Animals, but is a pure and very innocent *Saliva*.

To make good these assertions, M. *Chartas* affirms to have made new Experiments, in the presence of two or three hundred persons, Physicians and others, capable to Judge, and of great veracity; and to have found abundant cause to adhere to the result, he had made from his former tryals, *viz.* That never any one Animal of all those, he wounded, died of the jellow liquor let into the wounds, though drawn hot from the bags of the gums of Vipers much enraged. These Experiments are at length described in his Book.

If it be said in favour of Signor *Redi*, That the diversity of Climats, or of food also, may change the nature of Vipers, and cause that manifest difference between the Experiments; M. *Charas* answers, that it cannot be, That the nature of the Jellow liquor, and that of the Spirits should be so quite changed; because, that in *France* the same marks are found in the Jellow liquor with those described of *Italy*, and that the French Vipers do, without an intervention of the said liquor, kill as readily, as those of *Italy* can do. And he adds, that he hath verified it by very many Experiments, That all the Vipers of *France*, though taken in very different

different places, and those often distant from one another, above an hundred and twenty Leagues, do all kill equally.

And, as to the bilious expirations of Vipers, which may intervene with the Jellow liquor and render it venomous, he saith, That that is nothing but the angered Spirits under a disguise.

Now touching the enraged Spirits of Vipers, our Author, though he calls them Spiritual, or not Material, and maketh their Venom not visible nor palpable, yet certainly he will be understood to speak so in comparison to the Jellow liquor, which is a *visible* body; for, 'tis beyond all doubt, that those irritated Spirits are corpuscles, though not such as may be seen and handled like the said liquor, nor such as you may assign a particular place to in the body of the Viper, where they lodge; though it may be said, that being raised and severed either from the mass of the blood, or rather from the whole habit of the body, they rendezvouze in the head, being stirred up by the concussion and great commotion, which the Viper feels in her whole body when vexed; whereupon follows an eagerness of being revenged for the ill done them, and then a quick and fery action of the Spirits thus enraged. Nor can he mean, that these Spirits have neither place nor extension; for, how could they part from the Viper without having been in her body; and, how could they enter into the body of the Animal bitten without being there.

Further, to illustrate his notion of the Idea of the Viper for Revenge, he alledgeth the imagination of terrour by a Toad impressed in a Ferret, which having seen and been seen by that ugly Animal at a certain season of the year, and that alwaies in Summer, cannot avoid running round about it, crying out aloud as if it call'd for succour, whilst the Toad remains unmov'd with its throat open, and being at length, by that imagination, forced to surrender it self into that throat; as he affirms to have seen himself, and to have even kill'd the Toad at that very instant, and so saved the Ferret, which ran away. He alledgeth likewise a Mad Dog who can communicate his malignity to all sorts of Animals, none excepted: And why not then Vipers, convey their angry Spirits into such Animals as they meet with, and by them kill those they have bitten? Which, he saith, they execute by the perturbation and corruption, they introduce in the whole mass of blood, forasmuch as they obstruct the circulation and communication of
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the natural Spirits through the body. He adds the example of Men, capable to cause a grangrene and death it self by biting in choler ; whereas no such accident comes to pass, when they chance to bite one without choler. He concludeth this discourse with the sting of a *Tarantula*, which he conceiveth to be accompanied with an imagination, so strongly impressed in persons that are stung by it, as that their Spirits are perverted, and made conform to the agitating nature of the same, and constrained at certain times by certain tunes to dance, and to return to such motions every year. To confirm which, he relateth an example of a *Neapolitan* Souldier, who, he saith, hath been these four years in the *French* Infantry, and is still in the Royal Regiment of *Roussillon*. This person never failed to feel every year at a determinate time (*viz.* about the 24th. of *July*) the effects of that sting, which he had received before he came into *France*. And when the Idea's of the sting were found exalted to a degree capable to produce their effects, he began to dance, and would hear without interruption the Violins, which the Officers of that Regiment caused to be play'd for him out of charity ; to which he answer'd continually, keeping his time very well, without being tired, during three daies, eating and drinking without interrupting his dances, and being very impatient at any discontinuance of the play of the Violins. But on the fourth day his eagerness to dance abated, when he remembred all he had done, and knew all that were about him ; after which time, he passed the rest of the year without any inclination to dance. This Souldier, he saith, to have been seen thus to dance every year by thousands of people, and particularly in the Camp Royal A. 1670, where the King himself, and the whole Court saw him.

Lastly, M. *Charas* esteems, that Signor *Redi* would do well, if, for the satisfaction of the Publick, without standing up any longer for the venomousness of the Jellow juice, which he thinks hath been so rationally contested with him, he would take the pains to look after some other thing, that might be common to the Vipers of *France* and *Italy*, and that might have the same disposition of matter, the same power of acting nimbly, and deserve to be equally declared to be the true feat of their Venom ; that so Signor *Redi* might as validly exclude from it the enraged Spirits, as he (M. *Charas*) now does the Jellow liquor : But if he can find none such,

our Author thinks, he can have no ground to maintain his opinion, or contend against that of the vexed Spirits any longer.

III. *The CHIRURGICAL and ANATOMICAL Works of Paul Barbette M.D. Practitioner at Amsterdam; together with a Treatise of the PLAGUE. English'd out of Low-Dutch. London 1672. in 8°.*

THE skilful and diligent Author of this Book seems to have set down therein that Practice, which Reason and Experience, after a careful reading of the best Authors, and an exact Observation of several Operations, had taught him to be the safest, convenientest, and most easie. This he hath done in a few Chapters, rather inserting in short his Observations in the very descriptions of the *Diseases*, than to waste the Readers time with a prolix Discourse; to the end he might not repeat in *particular Diseases*, what he had first set down in *Generals*.

Tumors, Wounds, and Ulcers, which neither in Cause nor Cure differ, he hath reduced under one head; contrary to what most Writers use to do, who only from the difference of the Part and Member affected difference the Diseases, which afterwards, giving them new names, they multiply without any use; and so they render that Art, which is difficult enough of it self, much more difficult.

Those Medicaments, which he hath delivered in this Book, though they be few in number, yet are by some able Judges esteem'd of great vertue; which the Author affirms to have found out by vast pains and no small charges, and for the safety of which he alledgeth the confirmation of daily practice.

And because *Anatomy* is the main foundation of *Chirurgery*, the Author hath thought good to annex so much of it, as may be necessary for the Art; of all which he shews the Uses of it in the same.

He subjoyns also a small Treatise of the *Plague*; discoursing of its Causes, Symptoms, Observations, and Cure; and illustrating all with divers select Practical Observations.

IV. *The AMERICAN PHYSITIAN; or a Treatise of Roots, Plants, Trees, Shrubs, Fruit, Herbs, &c. growing in the English Plantations in America: whereunto is annexed a Discourse of the Cacao-nut-Tree, and the use of its Fruit.* By W. Hughes. London 1672. in 12o.

THough the Author of this Tract do only promise in the Title of it to give an Account therein of the Vegetables growing in the *English Plantations of America*; (which is of good use, forasmuch as it may make a part of the Universal History of Nature, now more than ever laboured after by the generous Philosophers of this Age;) yet he indeed performs more: since he presents his Readers with several particulars, that are without the Sphere of the Vegetable Kingdom; such as are the *White-Coral-Rocks*, to be found upon the Coast of Jamaica, as well as in other parts of America; the *Sea-star-Fish*; the *Allegator*; the easy way of *making good Salt* in Jamaica: For the particulars of all which, we refer to the Book it self.

ERRATA in Numb. 82.

Page 4051. line 17. read, *are 1044*, instead of, *are 144*. Ibid. l. 34. r. *and the other two*, instead of, *50 of them*.

L O N D O N,

Printed for John Martyn, Printer to the Royal Society. 1672.

PHILOSOPHICAL TRANSACTIONS.

June 17. 1672.

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Additions to the Narrative publish'd in Numb. 58. about the Conjunction of the Ocean and Mediterranean by a Channel in France. A Letter of P. Pardies, containing some Animadversions upon Mr. Newton's Theory of Light. An Answer of Mr. Newton to that Letter. Two Observations of Stones found, the one in the Bladder of a Dogg, the other fastned to the Back-bone of a Horse. An Account of some Books. I. An Essay about the Origin and Virtues of GEMS; by the Honourable Robert Boyle Esquire. II. Johannis Swammerdami M.D. UTERI MULIEBRIS Fabrica, una cum Methodo nova Cavitates corporis ita preparandi, ut suam semper genuinam faciem servant. III. Three Letters of Johan. Dom. Cassini, concerning his Hypothesis of the Suns motion, and his doctrine of Refractions. IV. Dr. Richard Sharrocks History of the Propagation and Improvement of VEGETABLES, by the concurrence of Art and Nature: The Second Edition much enlarged.

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Some

Some Additions to the Narrative, that was publish'd Numb. 58. about the Conjunction of the Ocean and Mediterranean by a Channel in France; In which Additions the Progress and the designed Usefulness of that great Undertaking are more amply represented: Out of a French Letter, written by Monsieur de Froidour to Monsieur Barrillon, and printed at Tholouse this very year.

IN the Description of this Channel, inserted in *Numb. 58.* of these *Tracts*, there was some mention made of the great *Magazin* of Water, for a continual supply in case of want thereof. This Store-house is more fully described in this Letter; where 'tis related, That it is in a Valley a little above the town of *Revel*, at *St. Feriol*; and that 'tis to be filled with the waters of the *Rivolet Andot*, and those of Rain and Snow, that are wont to be very plentiful upon the *Black-mountain*. This Valley is very narrow at the beginning, large in the middle, and streightened at the foot by the approach of two Rocky Hills, bounding it on both sides; which, to make a Lake and to keep in the water, are conjoyn'd by a *Causey* of such a height and thickness, that it may be call'd a third Hill. This *Causey* is 61 fathoms broad, and is to be 25 fathoms high, and 500 fath. long, to gain the Hills on both sides. The *basis* of this great work is a solid Body of Masonry, laid, and every way enclosed within the rock. It hath only a small Opening below in the form of a Vault, which is even with the ground, to serve for a passage to the water of this *Magazin*: This passage is 9 feet large, 12 feet high, and 94 fathoms long. Upon this Body of Masonry, which by some fathoms exceeds the height of the said Vault or Aqueduct, there is raised a thick Wall from the top of this Dam, down in a streight line to the foot of it. This Wall incloseth within its thickness another Vault, in the manner of a Gallery; the entry whereof, being at the foot of the *Causey*, is of the same height and breadth with the former. This Gallery answers directly, from the top of the *Causey*, to the Orifice of the Aqueduct, 5 fathoms above the surface of the ground, and it runs down along the side, and on the left hand of the Mouth thereof.

On this work there are built three thick Walls a cross it, that go from one end of the Causey to the other, founded upon the Body of the Masonry, and running into the work of the Gallery, which they traverse cross-wise. They are ancred and enchased, on the right and the left, in the rocks of the two skirts of the Valley. The *first* Wall, which is at the beginning of the Causey, is 12 feet thick at the end, being much broader below by reason of the *Talu* or slope: It is to be but 12 fathom high. The *second*, to be more raised, is 3 fathoms thick, and 25 fathoms high: It stands very near in the midst of the Causey, 33 fathoms distant from the first. The *third*, which maketh the foot of the Causey, and is 31 fathoms off from the second, is 8 feet thick, and 15 fathoms high. The empty space between the first and second wall is to be filled with stones and earth well ramm'd together and made even, so that it may be cover'd with a bed of loam 6 feet thick, sloping, and insensibly descending from the second to the first Wall; that so the water, that shall be made to swell to the height of 20 to 25 fathoms, spreading it self upon this *glacis* or slope, and to lean every where on its center, may not spoil the Causey. In the like manner is to be filled up the empty space between the second and third Wall, descending also slope-wise from the second to the third, to serve for a buttress to the second, that is to bear all the weight and force of the Water.

All these Walls, and even those of the Gallery, are to be counter-walled by a Wall of two feet thickness. Besides, the Gallery is to be counter-vaulted by another Vault; and the intermediate empty spaces are to be done up with a clayie earth well ramm'd; that so, in case that by any extraordinary accident the water should come to make any gap in the loam-bed, that is between the first and second wall, the rest may by this means be preserv'd entire.

In the first Wall there are Stones in toothings, from the top to the bottom, on the right and left of the Aqueducts mouth, and of the Galleries window: And this is to make a Cavity chamber-wise, four foot square. The Wall of this little structure is to be six feet thick, counter-walled with another Wall two feet thick, with a loam-bed between, to keep it safe. It shall end on the top above the Gallery, slope-wise

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and like a Vault, which is likewise to be counter-walled and counter-vaulted with clay between. This walled square Cavity is to be pierced by six or seven Metalline pipes, which shall be as big as those of Canons, and have their Orifices from without; thereby to receive the water of the Magazin to the height of the Gallery. The Cocks are to be within, shut up in the little space that the said Cavity is to contain, for to cast the water down so as it may have a fall of four fathoms. These Cocks shall be open'd through a window that is at the end of the Gallery. And there is to be yet another little aperture beneath, at which one may descend into this Chamber, in case the passage of the water shall be incombred, or that any other inconvenience is to be remedied. For which purpose there shall be fastned eight bars of Iron in the Walls, like a kind of stairs, for the conveniency of those that shall go down.

This Gallery is only to serve for passing to open the Cocks, according as there shall be need of water: And the water falling down will find issue through the Aqueduct, following the bed of the rivolet *Audot*, falling into the Deriving Channel below the Village *Vandreiil*.

It was necessary to place these Pipes so, as that they might not take the water but at about four fathoms high from the ground, because 'tis not possible to make such a great collection of waters in this Conservatory, especially of such waters as come, in part, from Snows and Rains, without store of dirt, sand, stones, pieces of wood, from the neighbouring Forests; and therefore there was an absolute necessity to leave some space for all this stuff, to prevent obstructing or spoiling the Pipes. On which occasion it is to be added, that forasmuch as in length of time this dirt may be heaped up to such a height, as to stop up the Pipes; to avoid this inconvenience, there hath been made in the said square Cavity an Opening below, answering to the Aqueduct; which Opening is to be commonly shut by a great Iron-gate, that can be drawn up, or opened at pleasure from the Gallery; that so the water finding this vent, and forcibly issuing, may carry with it all the dirt, or other stuff that shall be gathered at the bottom of this Store-house.

This

This Work is so well contrived and executed, that 'tis thought there never was seen in the world a Body of Masonry more solid than this; the charges of which are yet not considerable in proportion, because the Stones, Lime, Sand and Water are to be had upon the place.

As to the Grand *Bason*, to which the Waters of the Store-house are by the Channel of St. *Feriol* to be conveyed; the figure and compass of it having been already described in the *Transactions* above-mention'd; we find only these particulars to be added thereto, *viz.* *That* it is to be two fathoms deep all over; *that* it receives the waters of the said Channel at one of its Corners, and distributes them by two others, through two Channels, into the Ocean and Mediterianean; *that* there are moreover to be two other Channels; one to discharge the *Fason* when there is too much water; the other is not to come out of the *Bason*, but the Deriving Channel, to make the dirty waters, that it may bring down, to run out, that so the Pond receiving no other but clear and clean waters, may not be filled up with mud.

This *Bason* is in a manner quite done. For its ornament, it is to have not only an elegant key, but a regular Town built round about it after the model of the *Place Royal* of *Paris*; all the houses alike and equal, with great Arches beneath, to go under cover to the Key. There is also to be an Arsenal, for Boats to lye under, and for containing all necessaries to build and furnish them.

If any one shall ask, how far this Work is advanced, this Author assureth, that there is so much of it done, that before the end of this year it will be Navigable from the *Bason* to the *Garonne*. And if it should be doubted, whether the above-described Store-house will be sufficient to furnish water at all times; the same tells you, that the places are so disposed, that below that great Magazin one may make two or three more, and with little cost convey in Winter the superfluous waters of the same Rivers, that come out of the Black Mountain, into them, for a further supply.

This Royal Channel is every where five fathoms large at the bottom, and for the most part nine fathoms and two feet broad above. It is ordinarily between six and nine foot deep, and sometimes

sometimes more. And in regard that there is a considerable fall for about ten Languedoc-leagues, from the Point of Distribution (where 'tis highest) unto its discharge into the *Garonne*, where it is very low, you descend and ascend by the means of eighteen Slufes, which at certain distances do cut this Channel, and bear up the waters that are above.

But, as to the Communication of this Channel on the other side of the Great Bason towards the *Mediterranean*; that will require time: Yet the Work is there begun, and the same order and rules will be observ'd on that side, as on the other, as well for the opening of the Channels, as the structure of the Gates and Sluces. And here is not to be omitted, what is most important for this Communication, which is, That they have undertaken to make a Sea-port at Cape *Cette*, as the most convenient place on that Coast for such a purpose; and that there are already a thousand men working at it. *Cette* is a Promontory near *Frontignan*; on one side it hath the Sea, and on the other, the Lakes of *Thau*, *Magelonne*, and *Peraut*, bounded by the Plains of the lower Languedoc. The Sea there hath been found deep enough for Ships of five and six hundred Tuns; and round about the Cape there is 20, 21, 23, 24 feet of water. And here it is, where a *Mole* is not only begun to be made, but considerably advanced; inasmuch that many Vessels lye there already with safety, there being not a day, but some Ship or other comes in for shelter; and others also come there to lade from *Genoa*, *Narbonne*, &c. And not long since it happen'd, that in a very violent Tempest on that Sea, there came in seventy Ships, and saved themselves here; and at another time, upon the like occasion, forty five Sail retired thither, and so escaped Ship-wrack: besides that the Ankrage is very good on that Coast. All which giveth encouragement to build there a good Town; there being already made a number of small houses for Workmen to live in.

This Cape *Cette* is by a Cut of eight hundred fathoms joyn'd with the Deep Lake of *Thau*; which Cut is almost finish'd. And when altogether perfected, it will prove a considerable Harbour and place of Safety for those that navigate in this part of the *Mediterranean*, call'd the *Gulf of Lyons*, which extends it self from the Coast of *Provence* all along that of *Languedoc* and
Roussillon

Rouffillon unto Spain, and is so famous for Storms and Wracks; Navigation being there the more dangerous, because the Southern Winds reigning in this Sea, and alwaies by their force driving the Ships to the shore, these are in continual danger of splitting upon the Sands, for want of an Haven to retreat unto. So that by the Establishment of this Port, Navigation will in those parts be rendred much more safe, and a gate to Commerce opened to *Languedoc*.

But to speak in general of the main advantages, aim'd at by this Communication of the two Seas, there are three; *First*, that by this means *Languedoc* will be in a capacity of vending their Commodities of Oyles, Wines, Grains, Wool, in which that large Province abounds. *Secondly*, that whereas hitherto they have been obliged to carry all the Merchandises of the *Levant*, with great charge and danger, all along the coast of *Spain* round about, through the Straights of *Gibraltar*; the same may henceforth be brought to *Bordeaux*, and other Ports of France lying upon the Ocean, by a much shorter, surer, and even, as 'tis thought, a cheaper way: However, the Boats that will be able to go in this Channel, can have no more than 8, 9 or 10 fathoms in length, and $2\frac{1}{2}$ or 3 fath. in breadth. *Thirdly*, that henceforth a man may travel round about *France* by Water, save four days journey by Land. For by taking Boat at *Guyse* on the River of *Oyse*, lately made Navigable above *Fere*, one may descend unto its mouth, where it enters into the *Seine*; and then, passing *St. Germain*, *St. Denis*, *Paris*, *Corbeil*, *Melun*, go up as far as *Montreau*, and there take the River *Yonne*, and go as far as *Auxerre*; where you quit the River, and go by land to *Chalons*, seated on the *Soane*; descending thence to *Lyons*, and so falling down to *Tarascon*: And having left the *Rhone*, take the *Robine* of *Aigues-mortes*, which is an ancient Channel, communicating from that River with the Lakes of *Languedoc*; and so afterwards go up through the Channels of *Narbonne*, *Car cassone*, and *Castlenandary* to *Tolouse*; thence pass on the *Garonne* to *Bordeaux*, and there embarque, and coast it about that part of *France* which lyes upon the Ocean, and so re-enter the *Seine*, and see *Roan* and the other Towns lying on that River, until you come again to the mouth of the *Oyse*, whence you first parted.

So far the *first* Letter of M. *Froidour*; who in a Second to the same M. *Barillon* declareth, that they are convinced of the safety and usefulness of the Port of *Cette*, and that a great Trade is actually begun there: As also, that a stately Barge, expressly made for the solemnity, had, together with three of the greatest Vessels of the *Garonne*, passed with good success to *Naurouze*, the place whereabout the great Basin is. To which he adds, that if they continue to work at this Channel with the same care and fervour they now do, in two years time the whole Communication will assuredly be compleated.

In a *third* Letter the same person takes notice, that about six weeks before the time of the writing thereof, of three Ships of *St. Malo*, that were in a great Storm in the *Gulf of Lyons*, two having been broken upon the Sands, for want of knowing the Port of *Cette*, the third, holding out somewhat longer, and seen from that Cape, and thence succour'd by some Chaloups, which advertis'd him that he was near the said Port, arriv'd there and was saved. He concludes this Letter, by assuring his Friend, that if the Channel were as well finish'd on the side towards the Mediterranean, as 'tis on that towards the Ocean, the Country of *Provence* might have drawn this year more than a Million by the sale of its Corn in *Malta*, *Sicily*, and many parts of *Italy*: And also, that the Undertakers did then resolve to wait upon the King, to give his Majesty an assurance of the success of this Work; and that none but ignorant and perverse Spirits can any more doubt of it.

A Latin Letter written to the Publisher April 9. 1672. n. st.
by Ignatius Gaston Pardies P. Prof. of the Mathema-
ticks in the Parisian Colledge of Clermont; containing
some Animadversions upon Mr. Isaac Newton, Prof. of the
Mathematicks in the University of Cambridge, his Theory of
Light, printed in N°. 80.

— **L** Egi ingeniosissimam Hypothesin de Lumine & Coloribus
Clarissimi Newtoni. Et quia nonnullam Ego operam dedi
in ista contemplatione atque Experimentis peragendis, perscribam ad
Te pauca, quæ mihi circa novam istam doctrinam occurrerunt.

Circa ipsam Luminis naturam illud profectò extraordinarium vide-
tur, quòd ait vir eruditissimus, Lumen constare ex aggregatione
infinitorum propemodum radiorum, qui suapte indole suum quisque
colorem referant retineantque, atque adeò nati apti sint certà qua-
dam & peculiari ratione, plus alij, alij minus, refringi: Radios
ejusmodi, dum promiscui in aperto lumine confunduntur, nullatenus
discerni, sed candorem potiùs referre; in refractione verò singulos
unius coloris ab aliis alterius coloris secerni, & hoc modo secretos,
sub proprio & nativo colore apparere: Ea corpora sub aliquo colore,
v. g. rubro, videri, quæ apta sint reflectere aut transmittere radi-
os solummodò rubros, &c.

Istæ tam extraordinaria Hypothesis, quæ, ut ipse observat, Di-
optricæ fundamenta evertit, præterque hætenus institutas inutiles
reddit, tota nititur illo Experimento Prismatis Crystallini, ubi ra-
dij per foramen fenestræ intra obscurum cubiculum ingressi, ac deinde
in parietem impacti, aut in charta recepti, non in rotundum confor-
mati, ut ipsi, ad regulas refractionum receptas attendenti,
expectandum videbatur, sed in oblongam figuram extensi apparu-
erunt: Unde conclusit, oblongam ejusmodi figuram ex eo esse, quòd
nonnulli radij minus, nonnulli magis refringerentur.

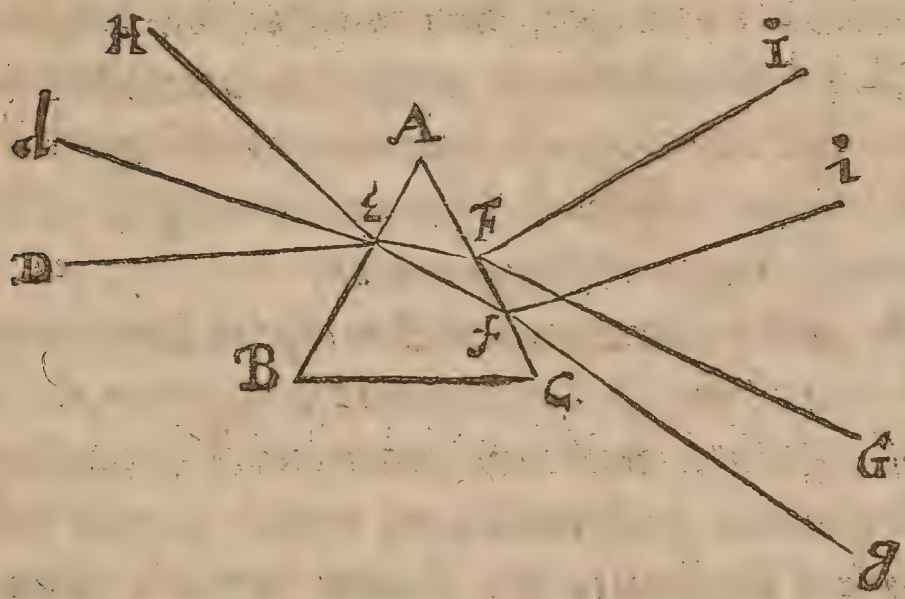
Sed mihi quidem videtur juxta communes & receptas Dioptricæ
leges figuram illam, non rotundam, sed oblongam esse oportere. Cum
enim radij ex oppositis disci Solaris partibus procedentes, variam
habeant in ipso transitu Prismatis inclinationem, variè quoque re-
fringi debent: ut cum unorum inclinatio 30 saltem minutis major
sit inclinatione aliorum, major quoque evadat illorum Refractio.

X x x x

Igitur

Igitur Radii oppositi, ex altera superficie Prismatis emergentes magis divergunt & divaricantur, quàm si nullatenus, aut saltem equaliter, omnes infracti processissent. Refractio autem ista radiorum fit solummodo versùs eas partes quæ fingi possunt in planis ad axem Prismatis rectis; nulla autem refractionis inæqualitas contingit versùs eas partes, quæ intelliguntur in planis axi parallelis; ut facile demonstrari potest: superficies enim duæ Prismatis censerì possunt inter se parallelæ, ratione habita ad inclinationem axis, cum singulæ ipsi axi parallelæ sint. Refractio autem per duas parallelas planas superficies nulla computatur, quia quantum à prima superficie radius in unam partem torquetur, tantum ab altera in oppositam partem detorquetur. Igitur cum radij solares è foramine per Prisma transmissi ad latera quidem non frangantur, procedunt ulterius, perinde ac si nulla Prismatis superficies obstitisset, (habitâ, inquam, ratione solum ad lateralem illam divaricationem;) at verò cum iidem radij ad superiores seu inferiores partes, alij quidem magis, alij verò minus, utpote inæqualiter inclinati, infringantur; necesse est eos magis inter se divaricari, adeoque & in longiorem figuram extendi.

Quin si calculus ritè obeatur; ut radij laterales inventi sunt à Cl. Newtono in ea latitudine quæ subtendit arcum $31'$, qui arcus respondet diametro Solis; ita nullus dubito, quin illa inventa quoque altitudo imaginis, quæ 2 gradus & $49'$ subtendit, sit illa ipsa quæ eidem diametro Solis post inæquales refractiones in illo ipso casu respondeat.



Et reverâ, posito Prismate ABC, cuius angulus A sit 60 grad. Radio DE, qui faciat cum perpendiculari EH angulum 30 grad. Invenio illum, dum emergit per FG, facere cum perpendiculari FI angulum $76\text{ gr. }22'$. At verò posito alio radio dE, qui cum perpendi-

culari

culari EH faciat angulum $29^{\circ}.30'$, invenio illum, dum emergit per fg, facere cum perpendiculari fi, angulum $78^{\circ}.45'$. Unde isti duo radij DE, dE, qui procedere supponuntur ex oppositis partibus disci Solaris, faciuntque inter se angulum $30'$, iidem dum emergunt per lineas Fg, fg, ita divergunt ut constituent angulum inter se $2\text{ gr. }23'$. Quod si duo alij radij assumerentur magis accedentes ad perpendicularem EH, (v.g. qui cum eadem perpendiculari facerent, unus quidem, angulum $29^{\circ}.30'$, alter verò, $29^{\circ}.0'$;) tunc iidem radij emergentes magis adhuc divergerent, constituerentque angulum majorem etiam aliquando plus quàm trium graduum. Et præterea augetur ulterius ista intercapedo refractorum radiorum ex eo, quòd duo radij DE, dE, concurrentes in E, illico incipiunt divaricari, atque impingunt in duo puncta disjuncta alterius superficiei, nempe in F & in f. Quapropter non sufficit ad obeundum ritè calculum, ex longitudine imaginis impactæ in chartam subtrahere magnitudinem foraminis fenestræ; quandoquidem etiam posito foramine indivisibili E, adhuc fieret aliud veluti foramen latum in alia superficie, nempe Ff.

Quod etiam vocat Experimentum crucis, mihi quidem videtur quadrare cum vulgaribus & receptis Refractionum regulis. Nam, ut modo ostendi, radij solares, qui accedentes & convergentes faciunt angulum $30'$, egredientes deinde etiam post indivisibile foramen divergunt in angulum duorum & trium grad. Quapropter non mirum, si isti radij, sigillatim impingentes in alterum Prisma, perexiguo item apertum foramine, inæqualiter infringantur, cum sit inæqualis illorum inclinatio. Neque refert, quòd isti radij attollantur aut deprimantur per conversionem primi Prismatis, manente immoto secundo Prismate, (quod tamen in omni casu fieri non potest) vel quòd manente primo immobili, secundum moveatur, ut successivè radios color itos totius imaginis excipiat & per proprium foramen transmittat; utrolibet enim modo necesse est radios illos extremos, hoc est, Rubrum & Violaceum, incidere in secundum Prisma sub inæquali angulo, adeoque eorundem refractionem esse inæqualem, ut Violaceorum sit major.

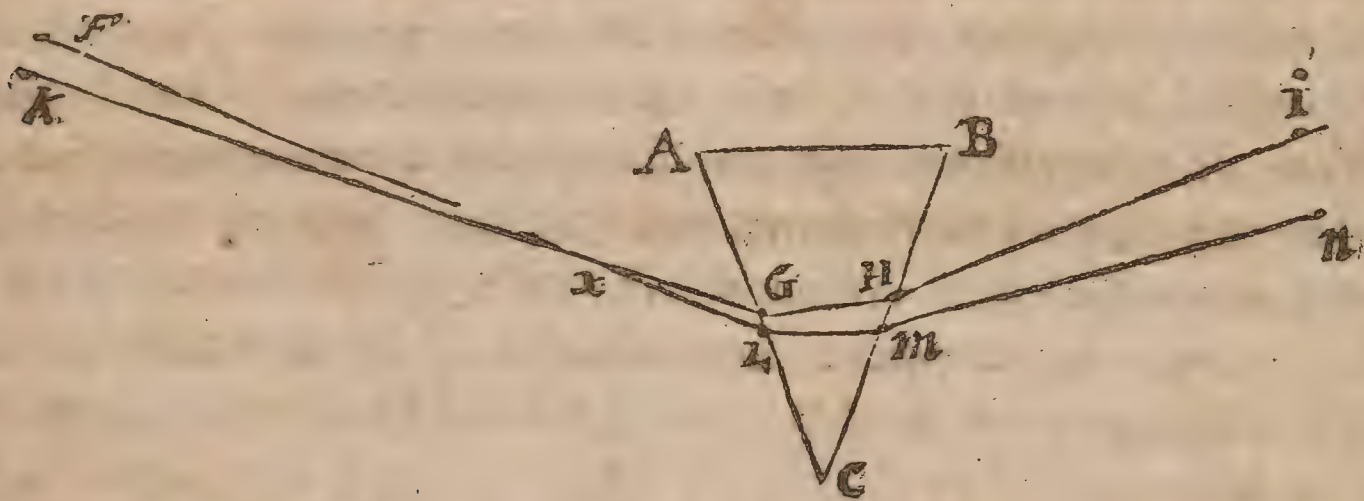
Cum igitur manifesta causa appareat oblongæ ejusmodi figuræ radiorum, causaque illa ex ipsa natura Refractionis oriatur; non videtur necesse recurrere ad aliam Hypothesin, aut admittere diversam illam radiorum frangibilitatem.

Quod deinde excogitavit de Coloribus, illud quidem egregie consequitur ex precedente Hypothesi; veruntamen nonnullae & ipsum patitur difficultates. Nam quod ait, nullum colorem, sed potius candorem apparere, ubi omnes omnium colorum radij promiscue confunduntur, id verò non videtur conforme omnibus phaenomenis. Certè quæ variationes cernuntur in permistione diversorum corporum, diversis coloribus imbutorum, eadem omnino observantur in permistione diversorum radiorum diversis item coloribus imbutorum: Atque optimè ipse advertit, quòd quemadmodum ex flavo & caeruleo corpore exsurgit viridis color; ita ex flavo & caeruleo radio viridis item color efficitur. Quare si omnes omnium colorum radii simul confunderentur, necesse esset in ista hypothese, ut ille color appareret, qui revera apparet in permixtione omnium pigmentorum. Atqui si ista, hoc est, rubrum simul & flavum una cum caeruleo & purpureo aliisque omnibus, si quæ sint, contendantur & confundantur, non jam candidus, sed obscurus & satur color exsurget. Ergo similis color appareret in lumine ordinario, quod constaret ex aggregatione omnium colorum.

Præterea nihil prime aspectu magis ingeniosum magisque aptum videtur, quàm quod ait circa experimentum acutissimi Hookii, quo duo diversi liquores, quorum alter rubeus, alter caeruleus, uterque sigillatim pellucidus, simul permixti, opaci evadunt. Id autem ait Clarissimus Newtonus ex eo oriri, quòd unus liquor solos rubeos natus sit transmittere, alter verò solos flavos; unde permixti nullos transmittent. Hoc, inquam, videtur statim valde appositum; nihilominus tamen ex eo conficeretur, quòd similis opacitas fieret in permistione quorumcunque liquorum qui essent diversi coloris; quod tamen verum non est.

Mr. Newtons Letter of April 13. 1672. ft. v. written to the
 Publisher, being an Answer to the fore-going Letter of
 P. Pardies.

— **A** Ccepi Observationes Reverendi Patris Ignatii Pardies in
 Epistolam meam de Lucis Refractionibus & Coloribus ad
 Te conscriptam: quo nomine me illi valde devinctum agnosco; atque
 hoc difficultatibus, quas proposuit, eluendis rescribo. Imprimis ait,
 longitudinem solaris Imaginis à refractione Prismatis effectam non
 aliâ indigere causâ, quàm diversâ radiorum ab oppositis partibus so-
 laris disci profluentium incidentiâ, adeoque non probare diversam
 refrangibilitatem diversorum radiorum. Et, quò assertionis ejus ve-
 ritatem confirmet, ostendit casum, in quo ex diversa incidentia 30
 minutorum, differentia refractionis potest esse 2 grad. 23. min. vel
 etiam paulo major, prout exigit meum experimentum. Sed ballu-
 cinatus est R. P. Nam refractiones à diversa parte Prismatis quan-
 tum potest inæquales statuit, cùm tamen ego tum in experimentis,
 tum in calculo de experimentis istis inito, æquales adhibuerim, ut in
 Epistola præfata videre est. Sit ergo ABC Prismatis sectio ad
 axem ejus perpendicularis, FL & KG radii duo in x (medio fo-
 ramini) decussantes & in Prisma illud incidentes ad G & L ;
 sintque eorum refracti GH & Lm , ac denud HI & mn . Et



eum refractiones ad latus AC æquales esse refractionibus ad latus BC
 quam proximè supposuerim; Si AC & BC statuantur æqualia, simi-
 lis erit radiorum GH & Lm ad AB basin Prismatis inclinatio;
 adeoque $\text{ang. } CLm = \text{ang. } CHG$ & $\text{ang. } Cmn = \text{ang. } CGH$.
 Quare etiam refractiones in G & m æquales erunt, ut & in L & H ;
 atque

atque addo ang. $KG A =$ ang. $n m B$, & ang. $F L A =$ ang. $B H I$; & proinde refractorum $H I$ & $m n$ eadem erit ad invicem inclinatio ac est incidentium radiorum $F L$ & $K G$. Sit ergo angulus $F n K$ 30 min. equalis nempe solari diametro, & erit angulus, quem $H I$ & $m n$ comprehendunt, etiam 30 min. si modo radii $F L$ & $K G$ equaliter refrangibiles statuuntur. At mihi experiienti prodiit angulus ille circiter 2 grad. 49. min. quem radius $H I$, extremum violaceum colorem, & $m n$, ceruleum exhibens, constituere; ac proinde radios illos diversimodè refrangibiles esse, sive refractiones secundùm disparem sinuum incidentiæ & refractionis rationem peragi necessariò concedendum est.

Addit præterea R. P. quòd non sufficit ad obeundum ritè calculum, ex longitudine imaginis impactæ in Chartam subtrahere magnitudinem foraminis fenestræ; quandoquidem etiam posito foramine indivisibili, adhuc fieret aliud veluti foramen latum in posteriori superficie prismatis. Mihi tamen videtur, his non obstantibus, quòd refractiones radiorum, in anteriori æquè ac in posteriori superficie Prismatis decussantium, ex adhibitis principiis possint ritè computari. Sed si res secùs esset, latitudo hiatûs in posteriori superficie, quod ad instar foraminis est, haud efficeret errorem duorum minutorum secundorum; & in rebus practicis non operæ pretium duco ad minutias istas attendere.

Illi insuper experimento, quod Crucis vocaveram, nihil adversatur R. P. dum contendit, inæquales radiorum, diversis coloribus imbutorum, refractiones ex inæqualibus incidentiis effectas fuisse. Nam radiis per duo admodum parva, ab invicem distantia & immota foramina, transeuntibus, incidentiæ illæ, prout ego experimentum institui, omninò æquales erant, & tamen refractiones liquidò inæquales. Sin ille de experimentis nostris dubitet, oro, ut radiorum diversis coloribus præditorum refractiones ex incidentiis paribus mensuret, & sentiet inæquales esse. Si modus ille, quem ego ad hoc negotium adhibui, minùs placeat (quo tamen nullus potest esse luculentior,) facile est alios excogitare; sicut & alios ipse haud paucos cum fructu expertus sum.

Contra Theoriam de Coloribus obijcitur, quòd pulveres diversorum colorum permisti non candidum sed subobscurum & fuscum colorem exhibent. Mihi verò albus, niger, & omnes intermedii fusci, qui ab albo & nigro permistis componi possunt, non specie coloris sed quantitate lucis tantùm differre videntur. Et cùm in mistione pigmentorum, singula corpuscula non nisi proprium colorem reflectant, adeoq; maxima

pars

pars lucis incidentis supprimatur & retineatur; lux reflexa subobscura evadet, & quasi cum tenebris permista, adeò ut non intensum alborem, sed qualem nigredinis permistio conficit, hoc est, fuscum, exhibere debeat.

Obijciitur deinde, quòd à liquoribus quibuscunque diversi coloris in eodem vase commistis, æquè ac in diversis vasis contentis, opacitas oriri debet; quod tamen, ait, verum non esse. Sed non video consequentiam. Nam plurimi liquores agunt in se invicem, & novam sibi mutuò partium contexturam secretò inducunt; unde opaci, diaphani, vel variis coloribus, ex coloribus permistorum nullo modo oriundis, præditi evadere possunt. Et hæc de causâ experimenta hujusmodi minùs apta semper existimavi, à quibus conclusiones deduci possint. Subnoto tamen, quòd ad hoc experimentum requiruntur liquores saturis & intensis coloribus præditi, qui per paucos nisi proprii coloris radios transmittant; quales rarò occurrunt, ut videbitur illuminando liquores cum diversis coloribus Prismaticis in obscurato cubiculo. Nam pauci reperientur, qui in propriis coloribus satis diaphani appareant, inque alienis opaci. Convenit præterea, ut adhibiti colores sint inter se oppositi, quales existimo fore rubrum & cæruleum, vel flavum & violaceum, vel etiam viridem & purpureum illum qui coccineo affinis est. Et ex hujusmodi liquoribus nonnulli (quorum partes tingentes non congregiantur) fortasse permisti evadent opaciores. Sed de eventu nihil sum sollicitus, cum quod luculentius est experimentum in liquoribus seorsim existentibus, cum quod experimentum illud (sicut & Iridis, Tincturæ Nephriticæ, & aliorum corporum naturalium phænomena) non ad probandam sed ad illustrandam tantùm doctrinam proposui.

Quod R. P. Theoriam nostram Hypothesin vocat, amicè habeo, siquidem ipsi nondum constet. Sed alio tamen consilio proposueram, & nihil aliud continere videtur quàm proprietates quasdam Lucis, quas jam inventas probare haud difficile existimo, & quas si non veras esse cognoscerem, pro futili & inani speculatione mallem repudiare, quàm pro mea Hypothesi agnoscere. Quid verò censerì mereatur, ex responsionibus ad animadversiones Domini N. N. fortasse statim prodituris clariùs patebit. Interea vale, & perge amare

Tibi devotissimum

J. Newton

Tm

Two Observations about Stones found, the one in the Bladder of a Dogg, the other fastned to the Back-bone of a Horse: both mentioned in two Roman Journals de Letterati.

I. **T**HE Dogg was a pretty Spaniel, two palms and a half high, white, and an excellent setter for Quails. Being kept tyed, as such doggs are wont to be, he would rather have burst than urine or dung in the place where he was kept. By reason of his aptness to bite, he was cut when he was five years old, and two years after that, he began to urine with much difficulty. Whereupon as often as he was let loose, he ran presently into the Garden and fell to eat of *Pellitory of the Wall*, and *Fig-leaves*. This disease continued upon him for five years together, sometimes with that violence that his Master had him siringed, and anointed with oyl of Scorpions, and used other remedies to help the poor creature.

At length he died at twelve years of age, and being opened by a skilful Anatomist, there was found in his bladder a stone weighing an ounce, of an irregular figure, white, yet here and there with some reddish specks; and in the bottom of the bladder was found store of small white gravel, and in the mouth of the urinal passage a stone as big as a great pine-kernel, white and tender. The rest of the body was all swelled.

It may be noted here (*saieth the Italian Journalist*) that *Matthiolus* and others say, that the Juice of *Pellitory* doth much provoke urine; and that it doth so especially, when being heated upon a tile and sprinkled with a little Malmesey, it is applied to the part. And as to *Fig-leaves*, he adds, that Physicians adscribe to Figs an absterfive vertue, opening the body and cleansing the reins: Of which vertue the Leaves may perhaps participate. Thus Brutes seem to know, without any direction from a *Dioscorides*, or *Matthiolus*, or other Botanist, the herbs proper for their diseases.

II. The other Stone, that was fasten'd to the *back-bone* of a Spanish Gelding, that died at the age of between thirteen and fourteen years, weighed four ounces and an half; it was round

round and a little flatted; of an olive colour, marked with red specks, like coagulated blood; and so polished and shining, that it reflected Images. It was wrapped up in a membrane full of fat, and fastned on both ends to the back bone, over against the Kidneys. Though this Horse had been dead twelve hours before it was opened; yet was it still very warm, and kept that warmth above six hours after it was opened. This stone is kept among the Rarities of Signor Bartolini, an Italian Riding-master.

An Account of some Books.

- I. *An ESSAY about the Origine and Vertues of GEMS; by the Honourable Robert Boyle Esquire, Fellow of the R. Society. Printed at London, 1672. in 8^o.*

THE design of the Noble Author of this excellent Treatise being, to propose and historically to illustrate therein some conjectures of his about the Consistence of the Matter of Precious Stones, and the Subjects wherein their chief vertues reside; he comprises the substance of all in these *two* particulars: *First*, That many of these Gems, and the Medical Stones, either were once *fluid* Bodies, as the Transparent ones, or in part made up of such substances as were once fluid. *Secondly*, That many of the *real* vertues of such Stones may be probably derived from the *mixture* of *Metalline* and other mineral substances, which are usually (though unsuspectedly) incorporated with them; and that the *greatness* of the Variety and Efficacy of those vertues may be attributed to some happy concurrent circumstances of that commixture.

The *first* of these Heads relateth properly to the *Origine* of *Gems*: the *second*, partly to that, and partly to the *kinds* and *degrees* of their *vertues*.

To countenance the former, the Author alledges for his *first* Argument several Considerations, taken first from the Diaphaneity of Gems; secondly, their external figuration; thirdly, their internal texture; fourthly, their Colours that seem to be adventitious and imparted by some coloured Mineral Juice, or some tinging Mineral exhalation, whilst the Stone was either

in solutis principiis, or of a texture penetrable by mineral fumes; fifthly, from the Heterogeneous matter included in Solid Gems, both transparent, and opacous, though very rarely in the former kind; sixthly, from the proofs, to be met with below in the second member of the Authors Hypothesis; wherein it appears, that several even of the Transparent Gems have metalline or other extraneous mineral bodies mingled with them *per minima*; which mixture is reasonably supposed to have been made, when the mingled bodies were in a fluid form.

These considerations being dispatch'd, they are follow'd with a very Instructive Answer to a main Objection, raised from the exquisite uniformity of shape, so admired in Gems, (especially the Prismatical one in Crystal,) and thought to demonstrate their being formed by a Seminal and Geometrizing Principle.

This done, the Author proceeds to the *second* of those Grand Arguments, whereon his Hypothesis was grounded. And this is built upon the *weight* of some Gems, which being greater than that which seems to belong to them as hard and transparent Stones, he thinks he may probably derive it from Metallin or Mineral mixtures. Where he shews, how he came to know the truth of what he here delivers, and what standard he pitch'd upon whereby to make a probable estimate of the weight of Gems; which was by finding out the Ponderousness of Crystal in reference to Water.

To this he subjoins a *third* Argument, taken from hence, that out of divers Medicinal Stones, and even out of some fine Gems, real and corporeal Metals or other Mineral substances may be extracted: which Argument he prosecutes largely in the *Second Section*; where he delivers

A Conjecture about the *Causes* of the *Virtues* of Gems; which is, That the Author conceives, that some (at least) of the *real* Virtues (the many *fabulous* ones being by him justly exploded) of divers Gems may be derived from this; That whilst they were in a fluid form (or at least not yet hardned,) the Petrescent substance was mingled with some Mineral solution or tincture, or with some other impregnated liquor, and that these were afterwards con-coagulated, or united and hardned into one Gem. And as divers of the Virtues of Gems may be in

a general way deduced from the Commixture of these Mineral Corpuscles ; so the greatness of those virtues and the variety of those proprieties in particular may be ascribed to the peculiar nature of the impregnating liquors, to the diversity of them, and to the greater and lesser proportions, wherein they are mixt with the petrescent Juice.

Having made this Conjecture probable as to *Transparent Gems*, and withal occur'd to some specious Objections; he descends to make it out, that those Arguments, which he hath produced to prove, that Diaphanous Gems may be endow'd with Virtues by the Mineral substances they contain or are in part made up of, will hold more strongly as to *Opacous* ones : which he further confirms by four particular Arguments ; fetched *partly* from the great specifick Gravity of divers Opacous and Medicinal stones ; *partly* from the fitness of his Hypothesis to render a reason of divers *phenomena* relating thereunto, some of them scarce at all, and others much less probably to be accounted for without it ; *partly* from the Metallin substances to be manifestly separated or obtained from the Stones he is treating of ; and *partly* from the Nature of the Bodies whereof Medicinal Stones seem to be compounded : In which last it is peculiarly observed by the Author, that the subtlety and penetrancy of some Liquors, if duly considered, may evince it to be possible, that such Bodies should be petrified by them and with them, as may in part consist of Animal and Vegetable substances ; as in petrified Skulls, Bones, and pieces of Wood. Besides, that not only there may be *Bolus's*, Sealed Earths, and such like fossils that are commonly known to be Medicinal, hardened into Stone by petrifying Agents ; but that also other Earths, subject to be petrified, may have Medicinal and subtle particles of such a kind in them, as scarce any body would expect : of which he alledges some notable Instances. But for them, and many other uncommon observables we must refer the Curious Reader to the Book it self.

II. Johannis Swammerdami M. D. *UTERI MULIEBRIS Fabrica; unà cum Methodo nova Cavitates corporis ita præparandi, ut suam semper genuinam faciem servant.* Lugduni Batav. 1672. in 4^o.

THE Publisher of these Tracts thinks himself obliged in a particular manner to do right to the Learned Author of this Book, as well upon the account of the matter contained therein, as his obliging way of dedicating it by a Letter of June 14. 1672. to the *Royal Society*; in the doing whereof he shews himself so generous and candid, as notwithstanding the present Rupture between the two Nations, *England*, and the *United Provinces* (of which latter he is a Subject) he scruples not solemnly to acknowledge, *Nescire se* (to give you his own words) *quo factum sit fato, ut, quemadmodum Christianus Orbis non minima Religionis suæ incrementa Anglicæ genti debet; ita ultimis difficillimisquæ his temporibus apud Eam inventa sit ratio, quâ, missis inanibus Scholasticorum disputationibus, bonæ artes & scientiæ in solido locentur: Quod ipsum ut non postremam gloriæ Britannicæ partem absolvit, ita in causa esse ait, ut in Naturalis Philosophiæ negotio ad nullam aliud quàm Regiæ Societatis Tribunal provocare vel ausit vel debeat.*

But to pass to the particulars of the matter it self, they are chiefly two: *First*, he comments upon the *Prodromus* of that famous Anatomist D. Joh. Van. Horne, printed 1668; treating de *partibus Generationis in utroque sexu*: Unto which he adds such things as himself had observed on that subject; not allowing to the said Van Horne, that the *Spermatick Artery* hath no cavity; denying the *Spermatick Vein* to agree any waies with the Scheme of De Graaf; affirming the processes of the *peritoneum* in men and women not to go beyond the *inguina*; observing that De Graaf is not well acquainted with the *ductus* of the veins and arteries in *testiculis*; doubting yet, where, and how the *vasa testicularia* do unite with the *præparantia*; denying, that the same *vasa testicularia* have a connexion with the *ductus Highmorianus*, and affirming them to be continued with the *Epididymis*; denying likewise, that the *vasa deferentia* have a communication

with

with the *vesiculæ seminales*, against Dr. De Graaf; maintaining, that there is (not a threefold Seed, but) a threefold matter of Seed, if not a fourfold; taking notice of the admirable structure of the Spermatick Artery in *Tauris*; mentioning divers curious particulars in *pene*; as also in the structure of the *vesiculæ seminales*, especially in *Moles*; offering to verifie his Schemes of the *Uterus muliebris*, here delineated, by the part it self; and excepting against those of De Graaf; animadverting in some figures of that accurat Anatomist, *Malpighi*, especially as to the Spermatick parts of the Male, and the Spinal Marrow; affirming positively, *testiculos mulierum instar ovarij esse, & structurâ suâ cum reliquis animantium ovarii convenire*; and withal examining the manner of the motion and passage of Eggs out of the *Ovarium* into the *Uterus*; which he finds as obscure in creatures that are by all acknowledged to be Oviparous, as in the other femals; forasmuch as he cannot find any more connexion between the *Ovarium* and *Infundibulum* in Poultry, &c. than in Women: And if it have been observed, that in Hens the said *Infundibulum* hath with its membranous expansions embraced the *Ovarium*; he believes, that the same comes to pass in Women *tempore conceptionis*, and that then the *tuba Fallopiana*, being applied to the testicles, receives by its orifice the very Egg, that is to breed the foetus. Where he taketh special notice of *Frogs*, that at once lay many hundreds of Eggs, which do singly follow one another through the *ovi-ductus*; in which Creatures he meets with the same difficulty, since the orifice of the *tubæ* is not only near two inches distant from the *ovarium*, but also very straight, and withall seeming immovable, and un-applicable to that *ovarium*. He examines also that Observation of *Kerkringius* about a *fœtus* of three daies old.

Moreover he promises, that he intends in his curious Anatomical Treatise, which he designs to publish, to restore to the Liver its office of Sanguification; wherein he promiseth to himself the greater applause, because none (as he saith) hath hitherto been able to shew, that the Chyle is conveyed so far as to the lacteous vessels *primi generis*, as he calls them: which makes him to esteem, that 'tis nothing but a whitish *lympha*, that appears in the lacteous veins, and issueth out of the glanduls
of

of the Intestins, that receive their Juice from the Arteries.

After this he represents the *uterus humanus* in three very curious Schemes; one is of the *facies anterior*; the other of the *facies posterior uteri puerperæ*; the third of an *uterus Virginis*.

Where he inserts a very odd History of the force of Imagination in breeding Women, which is this: That a woman at *Utrecht* in such a condition, being surpris'd with the sight of a *Negro*, and so exceedingly frighten'd as to become speechless for the time, had a strong fancy she should bring forth a black child; but, having recollected her self, did by as strong a fancy devise a remedy to defeat the former; which was with hot water to wash away that blackness. And having, whilst she was thoroughly possessed with this latter fancy, washed her self accordingly from top to toe; she was at length delivered of a child that was indeed white, yet those parts excepted, where the water in the washing had not touch'd; such as the interstices of the fingers and toes and some other places, where the manifest tokens of blackness appear'd; as this Author had been informed by the very Mother of this child.

The *second* main particular in this Book is, the Description of a way, so to prepare the Veins and Arteries and other hollow Vessels in an Animal, that they may appear in their genuine shape, whereby their structure, scite, ductus, insertion, rise, and the like, may clearly be seen. This way we shall give you at length in his own words; there being as yet but this one Copy, whence this account is given, in England, for ought we know.

Recipe Cerae albæ quantum videbitur, eamque liquefactam rubro, flavo, viridi, vel quolibet alio colore convenienti tinge; Et siphone, qui cochleâ adstrictum tubulum habeat, properanter excipe, atque in majorem venæ vel arteriæ uteri ramum injice, cavendo ne intercedens Aer progressum ceræ impediatur: Ac, ne quid impedimento sit, sanguinem, priusquam operi te accingas, ex venis quantum pote exprime, ut utramque majores alias facillimè distendantur. Perinde autem est, si per Arteriam spermaticam siue hypogastricam Cera injiciatur: Idemque in venis obtinet, tantum ut valvula obtuso stylo pertendantur; quo facto unâ injectione omnes uteri venæ, earumque partes vel ab uno latere impleri possunt. Idem in Arteriis fieri potest, si tamen visibiles earundem Anastomoses satis magnæ sint, nec Aer progressum ceræ impediatur.

By

By this method he affirms to have laid open even the smallest ramifications of the *Arteria hepatica*, that cannot be bared of the flesh, and that are possibly more in number, than those of the *vena porta* and *cava* put together.

III. *Three Letters of Jo. Dominicus Cassinus, concerning his Hypothesis of the Suns motion, and his doctrine of Refractions; printed at Bononia in 4°.*

THE first Letter is in Latine, to *Geminian Montanarius*, publick professor of Mathematicks in *Bononiensi Archigymnasio*; who was calculating Ephemerides of the Suns place, according to the latter Hypothesis of *Cassinus*. His former Hypothesis was grounded upon Observations of the Sun, from whose Altitudes, when they were great, he made no Abatement; because, according to the common opinion, the Refraction is nothing, or, at least, inconsiderable. A specimen of it, was published about 16 years ago. But afterward he changed that Hypothesis, that it might agree with his observations as diligently made, but more artificially corrected. For, having *ex meris stellæ Polaris altitudinibus exactissimis* determined the height of the pole (and thereby of the Equinoctial,) at *Bononia*; he observed also the Suns meridian height in both Solstices. And subtracting that winter-height from that Equinoctials height; and the said Equinoctials height from the Summer height, he alwaies found that former difference less, by above four minutes and an half, than the latter difference. Wherefore he attempted to order the Parallaxes and Refractions so, as that those Summer and Winter observations, being corrected according to that doctrine, might yield the Suns Southern greatest declination, equal to the Suns greatest declination Northward. In this Letter he sets down, What course he took to find the Refractions; What Experiments he made in glas and in water; How he applied them to celestial Refractions; His proceeding to determine the proportion of the height of the Air to the Semidiameter of the Earth; And at last to make Tables *ad singulos gradus apparentis distantie à vertice*. Those Tables make it evident, that *Refractiones etiam in æstivis altitudinibus sunt sensibiles, & ad verticem usque conscendunt*; which hitherto hath alwaies been denied. Not only his friends in Italy approve these Tables, but in France also. *Petrus Petit in præclaro opere, quod DE NUPERIS COMETIS*

COMETIS scripsit ediditque, saith, Cassini Tabulas (refractionum) & rationibus & Experimentis esse conformes.

But *Ricciolus*, in a late treatise *Astronomiæ reformatæ*, hath raised an Expectation of his new Tables of Refraction, and questions those Tables of *Cassinus*: Who, in this Letter, answereth his objections, and shews, how, by observations in *Heliometro*, we may try whose Tables are best.

The second Letter is in *Italian*, to *Carlo Rinaldini* Professor of Mathematicks in the University of *Padua*; dated *August. 7. 1666.*

In it, He shews some defect in the wayes of making Experiments of Refraction, prescribed by *Vitello*, *Des-Cartes*, *Riccioli* and *Manzini*. And then he describes an Instrument of his own invention for that purpose &c.

The third Letter is in *Italian* also, but without date: concerning a book of *Dr. Mengoli*; wherein is a Table of Refractions for every degree of altitude. But *Cassinus* shews, that Table of *Mengoli* to be false; as being easily refuted by Experience, and grounded upon a wrong foundation. Most writers of Dioptricks since *Des Cartes* do agree with him, in acknowledging a constant Ratio in the Sines of the Angles considered in Refraction. But this Doctor *Mengoli*, mistaking those Angles, hath cast away a great deal of labour in calculating so many Refractions, and so making a Table full of false numbers. But *Cassinus* hopeth, that *Signor Mengoli* will review his Principles, and put true ones in their room, that so beginning anew he may reform the Conclusions, which he intended to demonstrate.

IV. *Dr. Richard Sharrock's History of the Propagation and Improvement of VEGETABLES; by the Concurrence of Art and Nature. The 2d Edition much enlarged. Oxford, 1672. in 8^o.*

THIS Treatise sheweth the several wayes for the Propagation of Plants usually cultivated in *England*, as they are increased by Seed, Off-sets, Suckers, Trouncheons, Cutting, Slips, Laying, Circumposition: The several wayes of Graftings and Inoculations; as likewise the Methods for improvement and best culture of Field, Orchard and Garden-plants; the means used for remedy of Annoyances incident to them; together with the Effect of Nature, and her manner of working upon the several endeavors and operations of the Artist. Written according to Observations made from Experience and Practice. Amongst the many considerables in it, there is an Examination of *Sr. Ken, Digby's* reports, and other stories of great fame.

Errata in Numb. 83 p. 4060. l. 16. and l. 28. r. refraction for reflexion. p. 4075. l. 26. and l. 33. r. weasel for ferret.

LONDON, Printed for *J. Martyn*, Printer to the Royal Society, 1672.

PHILOSOPHICAL TRANSACTIONS.

July 15. 1672.

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A Serie's of Quere's propounded by Mr. Isaac Newton, to be determin'd by Experiments, positively and directly concluding his new Theory of Light and Colours; and here recommended to the Industry of the Lovers of Experimental Philosophy, as they were generously imparted to the Publisher in a Letter of the said Mr. Newtons of July 8. 1672.

IN the mean while give me leave, Sir, to insinuate, that I cannot think it effectual for determining truth, to examin the several waies by which Phænomena may be explained, unless where there can be a perfect enumeration of all those waies. You know, the proper Method for *inquiring* after the properties of things is, to deduce them from Experiments. And I told you, that the Theory, which I propounded, was evinced to me, not by inferring 'tis thus because not otherwise, that is, not by deducing it only from a confutation of contrary suppositions, but by deriving it from Experiments concluding positively and directly. The way therefore to examin it is, by considering, whether the Experiments which I propound do prove those parts of the Theory, to which they are applyed; or by prosecuting other Experiments which the Theory may suggest for its examination. And this I would have done in a due Method; the Laws of *Refraction* being thoroughly inquired into and determined before the nature of *Colours* be taken into consideration. It may not be amiss to proceed according to the *Series* of these *Quæries*; which I could wish were determined by the Event of proper Experiments; declared by those that may have the curiosity to examin them.

1. Whether rays, that are *alike* incident on the same *Medium*, have *unequal* refractions; and how great are the inequalities of their refractions at any incidence?

2. What is the Law according to which each ray is more or less refracted; whether it be that the same ray is ever refracted according to the same *ratio* of the sines of incidence and refraction; and divers rays, according to divers *ratio's*; or that the refraction of each ray is greater or less without any certain rule? *That is*, whether each ray have a certain degree of refrangibility according to which its refraction is performed; or is refracted without that regularity?

3. Where-

3. Whether rays, which are endued with particular degrees of refrangibility, when they are by any means separated, have particular colours constantly belonging to them; *viz.* the least refrangible, *Scarlet*; the most refrangible, *deep Violet*; the middle, *Sea-green*; and others, other colours? And on the contrary?

4. Whether the colour of any sort of rays apart may be changed by refraction?

5. Whether colours by coalescing do really change one another to produce a new colour, or produce it by mixing only?

6. Whether a due mixture of rays, indued with all variety of colours, produces Light perfectly like that of the Sun, and which hath all the same properties, and exhibits the same *Phænomena*?

7. Whether the component colours of each mixture be really changed; or be only separated, when from that mixture various colours are produced again by Refraction?

8. Whether there be any other colours produced by refraction than such, as ought to result from the colours belonging to the diversly refrangible rays by their being separated or mixed by that refraction?

To determine by Experiments these and such like *Quere's* which involve the propounded Theory, seems the most proper and direct way to a conclusion. And therefore I could wish all objections were suspended, taken from *Hypotheses* or any other heads than these two; Of shewing the insufficiency of Experiments to determine these *Quere's* or prove any other parts of my Theory, by assigning the flaws and defects in my conclusions drawn from them; Or of producing other Experiments which directly contradict me, if any such may seem to occur. For if the Experiments, which I urge, be defective, it cannot be difficult to show the defects; but if valid, then by proving the Theory they must render all Objections invalid.

So far this accurate Proposer; whose Method appearing to be most genuine and proper to the purpose it is propounded for, and deserving therefore to be considered and put to trial by Philosophers, abroad as well as at home; the Publisher, to invite and gratify Forraigners, was willing to deliver the above recited Extract of Mr. Newtons Letter in the language also of the Learned, as followeth;

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Ex-

Excerptum ex *Isaaci Newtoni* Epistola, nuper ad Editorem script, quâ ipse genuinam suggerit Methodum, doctrinam suam de *Luc & Coloribus*, antehac propositam, evincendi, subjectâ certorum *Quæstionum*, debitæ Experimentis solvendorum, serie.

Liceat mihi hac occasione tibi significare, nequaquam censere me, efficacem eam esse determinande veritatis rationem, quâ diversi examinantur modi, quibus *Phænomena* explicari possunt, nisi ubi perfecta fuerit omnium istorum modorum *Enumeratio*. Nosti, genuinam proprietates rerum investigandi Methodum esse, quâ illæ ab Experimentis deducuntur. Ac jam antè tibi dixeram; Theoriam à me propositam evictam mihi fuisse, non quidem inferendo rem ita se habere quia haud se habeat aliter, i. e. non eam deducendo duntaxat à contrariarum suppositionum confutatione; sed ipsam ab Experimentis, positivè & directè concludentibus, derivando. Vera itaque ratio eam examinandi hæc erit, si consideremus scilicet, num Experimenta à me proposita illas Theoriæ partes, quibus accommodantur, reverà probent; vel si alia prosequamur Experimenta, quæ ab ipsa Theoria ad examinandam eam suggerantur. Atque hoc ipsum Methodo genuinâ fieri velim; per vestigatis primum ac determinatis Legibus Refractionis, priusquam Colorum natura disquiratur. Præter rem itaque haud fore crediderim, disquisitionem hanc ex sequentium Quæstionum serie institueræ; quæ quidem ut à solertibus sagacibusque naturæ Mystis, pronunciatis Experimentorum Eventibus, dirimantur, in votis quàm maximè habeo. Ea sunt;

Primò, Num radii, qui æquali incidentiâ in idem medium incident, Refractiones habeant inæquales; quantaque sint refractionum, quas illi subeunt, inequalitates in quavis incidentiâ?

Secundò, Quenam ea Lex sit, juxta quam radius quilibet magis minùsve refringitur? sitnè, quòd idem radius semper refringatur secundùm eandem rationem Sinuum Incidentiæ & Refractionis; diversi autem radii, secundùm rationes diversas? An verò, quòd cujuslibet radii refractionis major minorve sit absque ulla regula certa? Hoc est, Utrum unusquisque radius certum habeat gradum Refrangibilitatis, juxta quem fiat ipsius refractionis; an verò refringatur sine ista regularitate?

Tertiò, Num radii, certis gradibus refrangibilitatis præditi, quando, quodam cumque modo, secernuntur, certos obtineant colores ipsis proprios; puta radii minimè omnium refrangibiles, Coccineum; maxime refrangibiles, saturum Violaceum; intermedii, sub-Viridem; alii, alios? Et e contra.

Quartò, Num color cujusvis generis radiorum seorsim existentium mutari possint Refractione?

Quintò, Utrum colores coalescendo reverà se invicem mutant ad producendum colorem novum; an verò eum producant nonnisi se invicem commiscendo?

Sextò, Num debita radiorum miscela, omnigenâ colorum varietate prædita, Lucem producat Solari luci simillimam; quæque easdem omnino proprietates obtineat, eademque Phænomena exhibeat?

Septimò

Septimò, *Utrum componentes cujusvis miscela colores reverà mutantur; an verò secernantur duntaxat, quando ex mixtura illa varii colores rursus producuntur per Refractionem?*

Octavò, *Dentur ne ulli alii colores Refractione producti prater eos, quos oriri oportet à Coloribus, ad radios diversimodè refrangibiles pertinentibus, dum illi refractione istà secernuntur vel miscentur?*

Per Experimenta determinare hæc similiave Quæsitæ, quæ propositam Theoriam involvunt, maximè genuina directaque videtur ad Conclusionem via: Proinde quæ omnes velim Objectiones suspendi, quæ ab Hypothesibus desumuntur ullisve Fontibus aliis, quàm his duobus; quibus nempe vel ostendatur Experimentorum ad determinanda hæc Quæsitæ probandasve ullas alias Theoriæ meæ partes insufficientia, hallucinationes defectusque in Conclusionibus meis inde deductis indigitando; vel alia producantur Experimenta, è diametro mihi opposita, si quæ talia occurrere videantur. Si enim Experimenta, quæ à me urgentur, laborant defectibus, difficile haud fuerit eos ostendere; si verò valida fuerint, eo ipso dum Theoriam meam asserunt probantque omnes Objectiones convellunt.

Some Annotations of the Learned Dr. Walter Needham upon a Discovery pretended to have been made by the famous Monsieur Pecquet of a Communication between the Ductus Thoracicus and the Inferior Vena Cava.

The Relation it self of that pretended Discovery, as it is to be found in the Journal des Scavans, of Feb. 8. 1672.

TH E Discovery made about twenty years since by M. Pecquet of the *Ductus Thoracicus*, seemed not sufficient to clear up all the Difficulties to be met with in the New opinion, which this Channel hath occasion'd, concerning Sanguification.

It might be said among other things, That there appears no reason, why Nature, which does nothing without design, should carry the matter of the Blood into the *Sub-clavials*, and thence make it descend by the Trunk of the *Vena Cava*, (A.) unless it be to keep the Chyle from entering all at once and altogether pure into the Heart, and that the mixture, which is made of the Chyle with the Blood along this way, may dispose the Chyle, by a kind of contagious fermentation the

The Annotations of Dr. Needham.

(A.) **I** think the reason there mentioned to be very sufficient for the inserting of the Trunk of the *Ductus Thoracicus* into one place alone; at least as good as any that are afterwards given to prove the contrary. For, all proofs of this nature are but loose conjectures at the best: the matter admitting of no other demonstration than what is ocular.

(B.) Till the Lower insertion be shewed, we are bound to believe, that Nature thought the single more

more easily to receive the character of the Blood in the Heart : But that this might be more conveniently done, the *Ductus Thoracicus* being inserted into that trunk of the *Vena cava* which ascends to the Heart, because that this way is shorter, and is equally favourable to this commixture.

It might also be objected, that, supposing this commixture were of importance, the *Ductus Thoracicus* should communicate with the inferior trunk of the *vena cava* as well as with the superior, to the end that the moiety of the Chyle being mixt with the blood that comes from on high, and the other moiety with the blood that comes from beneath, (B) it might the more easily be altered by this commixture. And this Objection seemed the more rational, because, it being very likely that the Blood, which returns from the parts in which it hath received some impressi-
on in penetrating their porosities, communicates to the Chyle these same dispositions; there was reason to desire, that the Blood which re-ascends might in some degree impress the peculiar character of the inferior parts, as that, which comes from the upper parts, impresses upon it that which belongs to it.

(C.) Add hereunto, that the Blood which re-ascends to the Heart, must be more perfect than that which descends; because it comes from being purified in the Liver, Spleen, and Kidneys; so that it is capable to give (D.) to the Chyle good impressions.

(E.) Lastly, it might be said, that, supposing it be necessary that not only a portion of the Chyle pass through the Heart, to give it some kind of refreshment, but also that all the Chyle be conveyed thither for to be converted into Blood; the small orifices, which the *ductus thoracicus* hath in the subclavials, seem not to

commixture of Blood and Chyle sufficient. The reinforcement of that Objection answers it self, being proposed in no other terms than (it seems very likely;) the whole conjecture having yet had but very slender foundation in Philosophy. And if there be any thing in the notion of impressing characters, it is more attributable to the lymph. See beneath lit. D.

(C.) That the Blood, which re-ascends to the Heart, is purer than what descends from the Head, &c. is a notion that will not easily be granted, neither can it be made out by Experiment. I have my self compared the Blood of the Jugular vein with that of the Crural in a Dogg, and found no difference. The separations made by the Kidneys and Liver (if they prove any thing) prove the ascending blood to be thicker than the descending; it having lost in those places much of its serum and its lixivial salts, which are the great instruments of attenuation. But withall it is to be considered, that the Blood, which ascends from the Heart to the Head, parts with much excrement in the glandulæ salivales, and nostrils, and the whole throat; the quantities of which are much greater than will easily be imagined. There is like-
be

be large enough for that purpose.

(F.) The Observations, that have been made in the beginning of this year in his *Majesties Library*, by searching carefully the passage of the *Ductus Thoracicus* in the Body of a Woman, did shew, that these difficulties were well grounded. For, it hath been found by divers Experiments, made about this matter, that there *ascends* at least so much Chyle through the Trunck which is beneath the Heart, as there *descends* through that which is above it.

These Experiments have appeared considerable, in regard that they confirm those, which were also made by the same *Royal Academy of the Sciences* about five years since, and which were inserted in the 7th *Journal des Sçavans* 1667 *. But

*See Numb. 25. of these Tracts p. 461. where those Experiments were English't.

this last Experiment hath been clearer and ampler then the first, in that the Communication, which the first time appeared to be only with the left *Emulgent Vein*, hath been found this second time not only with this vein, but also with the two *Lumbar* veins, which are inserted in the Trunck of the *inferior vena cava*.

As to the manner of proceeding, in the presence of the whole Company, for finding this Communication, it was this: After there had been shewed the Commerce of the *Ductus thoracicus* with the Right Ventricle of the Heart by an injection of Milk, which having been syringed into the beginning of this Channel, issued in great quantity through this ventricle; we tyed the Trunck of the *vena cava* above the Heart, so that nothing might pass that way; and the Trunck of the *Emulgent* and that of the *Vena Cava* having been opened above long wise, some milk, ready to boyl, was (G.) injected

wise a great separation made in the brain; which whether it be of the purest and best spirits of the blood, so as to leave it depauperated; or only of a nutritious serum, such as is made in all the solid parts, is hard to say. Only this may be certainly said, that the Lympha does wholly exonerate itself into the sub-clavial and jugular veins near the place of the insertion of the Chyle; whereby the whole Chyle is diluted, and the mixture of it and the blood facilitated. Which very phænomenon is a greater argument to prove, that the Chyle does wholly enter by that passage, than any can be produced on the other side. For we see, all the Lympha, not only of the Liver and Intestines, but also of the lower limbs, to pour it self into the receptaculum chyli, and not into any of the lower veins: Whereas the Lymphatics of the Head, Neck and Arms, think it sufficient to meet the Chyle at the place of its entrance; which same thing might have been done by the lower Lymphatics, had they any Chyle to meet: The principal use of the Lympha seeming to be, to serve the uses of the Chyle and its mixture with the Blood.

(D.) What impressions are made on the Blood by the Liver, Spleen, Kidneys, &c. is into,

into the *Emulgent* through the left *Lumbary* vein (which we have ever observed to come from the *Emulgent*,) and at the same time we saw it come away through the other *Lumbary*.

This Experiment having been several times repeated without our being able to see the track, which we had observed under the *Pleura*, when the first Discovery of this Communication was made; which track seemed to shew the way, which the *Thoracick* branch keeps to entertain a communication with the *inferior venacava*: We resolved to attempt a more easie and a more certain method of discovering this branch, than the usual dissection of the vessels, performed by severing their proper tunics from a multitude of membranes and fatnesses, which lying and embarrassing them, render this work very difficult; especially when the vessels are not filled with blood to make them visible, and because they are composed of more delicate tunics, than those of the Veins.

(H.) This way was, to syringe into the Trunk of the *ductus thoracicus* a Composition, that might run into it being hot, and which by being refrigerated might become solid enough to afford a greater facility to follow and trace the channels, in the cavity of which it should be thus hardened. And this design succeeded in part. For, the Composition filled the whole *ductus thoracicus*, and ascended as far as into the *sub-clavial*; but there passed nothing into the channel that makes the communication sought for, though care was had to warm the ambient parts by several injections of warm milk; to the end that the Composition might not harden before it had penetrated into all the conduits. We also tryed to inject the same Composition through the *Lumbary* that issues out of the Trunk, if its valves would permit it; but they stopped all that we endeavoured

uncertain: But if there be any such made, the Liver and Kidneys do so readily exonerate themselves into the *vena cava*, that the impressions, be they what they will, are quickly conveyed to the Heart without any great diminution of them. And whereas the Author mentions the characters impressed from parts; those, (if any such be) may more justly be supposed to be conveyed in the lymph, which liquor seems to be a product of those parts curiously elaborated in the very substance of them.

(E.) What is sufficient and not sufficient, must be judged of by Nature, and not by Us. Yet, if we consider the time that is spent in carrying the Chyle up into the Blood, it is easie to believe, that a much greater quantity of liquor may be discharged by that ductus, than is usually pretended to.

(F.) What those Experiments are, we should be glad to know. But the Experiment of 1667 (if I rightly remember it) was only a *lusus naturæ*, found by M. Pecquet. Which I therefore call so, because neither he, nor any one else hath found it since: whereas the *vasa lactea*, and the waies of ordering them, are so well known, that, if any such thing were, it could not long be hid.

(G.) An Injection into the *Lumbary* vein with its effects.

to make pass that way, and neither the milk nor the wind would ever enter there.

(7.) The advantage we had from the Injection of this Composition into the said *Ductus*, was, that we very distinctly saw the figure and the whole structure of it, when the Composition wherewith it had been filled, was refrigerated and hardened. For we found, that that *ductus* did ascend unto the right side of the heart, keeping one and the same size, which was no more than $\frac{1}{12}$ of an inch; that afterwards it was enlarged to $\frac{1}{6}$ of an inch in diameter; that in this enlargement its tunicle on the right side of the *vertebra* was, as 'twere, pierced by four small holes, distant $\frac{1}{12}$ of an inch from one another, and all disposed in a row; into which holes the said Composition had not been able to penetrate; that the same *ductus*, after having retaken its first size, had two appendixes fashioned like sacks; that there was yet a third appendix beneath the dilatation; that the first and highest appendix was of the form and bigness of a small phaseolus; that the third, which was beneath the dilatation, was like to the second; that they had all a streight orifice; and that the last was full of chyle conspissate, so that the Composition could not enter there, as it had done into the other.

The Importance of these Observations ought to incite the Curiosity of those that are addicted to Anatomical researches, and to engage them to examin with care this New communication, to attain at last a clear accompt thereof.

trary, viz. all the *Lacteal* vessels (that are acknowledged to be such,) fully distended: Which is a full demonstration, that they have no way of evacuation by any other duct than the thoracique.

(J.) The other use of the coagulating Injection I applaud; though the same may be done by the Ligature abovesaid. However the event of the Experiment, made by the Learned Pecquet, makes against the opinion of a New ductus, and not for it; as appears by the Narrative.

The haste, in which this was written, begs your excuse.

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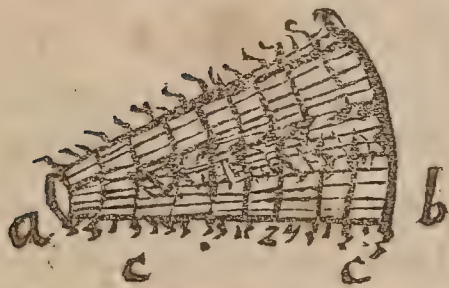
effects mentioned can prove nothing but the Inosculation of the two Lumbar veins with each other: which is acknowledged to be such in all the Capillary vessels of the same kind, viz. Veins with veins, and Arteries with arteries. But the thing required here is, the passage from the Receptaculum to the Lumbar vein, or to any other vein besides the Subclavial.

(H) The way of syringing a liquor, which is apt to coagulation, into the ductus thoracicus, &c I think to be needless and unprofitable as to this Inquiry, when there is a more easie Experiment to be made, which is more demonstrative, viz. Open a Dog at a convenient distance of time from his feeding, and then tie a ligature upon the ductus thoracicus nigh the Sub-clavial: your receptaculum chyli will continue full, 48 hours or longer, if you please: So that, if there be any such ductus, it must remain likewise full with its own natural liquor, and be all that while visible. But, if there were any such ductus, it would in a quarter of the time empty the whole receptacle; whereas upon a ligature you'l find the clean con-

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A Second Letter of P. Pardies, written to the Publisher from Paris
May 21. 1672. to Mr. Newtons Answer, made to his first Letter,
printed in Numb. 84.

R Eddite mihi sunt tue literæ cum Observationibus Clarissimi atque Ingeniosissimi Newtoni, quibus ad meas difficultates respondit. Eas ego legi non sine maxima voluptate: Et primum, quod attinet ad ipsum Experimentum majoris Latitudinis colorum quàm exigeret vulgaris Theoria Refractionum; fateor, me inæquales refractiones in oppositis Prismatis fascibus supposuisse, nec ulla tenus advertisse in literis relatis in Transactionibus, observatam fuisse à Newtono majorem illam latitudinem in eo casu in quo refractiones ponerentur reciprocè æquales, eo modo quo hîc in istis observationibus dicitur. Sed nec ab eo tempore in iisdem Transactionibus videre licuit, cùm eas non potuerim recuperare. Cùm igitur nunc videam, etiam in eo Casu observatam majorem illam Colorum latitudinem; ceriè ex hoc capite nihil mihi ulterius restat difficultatis: Ex hoc, inquam, capite; nam aliunde videtur posse reddi ratio illius Phenomeni absque ista varia Radiorum Refrangibilitate. Etenim in ea Hypothesi, quam fuisse explicat noster Grimaldus, in qua supponitur Lumen esse substantia quædam rapidissimè mota, posset fieri aliqua diffusio luminis post transitum foraminis & decussationem radiorum. Item in ea Hypothesi, qua lumen ponitur progredi per certas quasdam materie subtilis Undulationes, ut explicat subtilissimus Hookius, possunt explicari colores per certam quandam diffusionem atque expansionem Undulationum, qua fiat ad latera radiorum ultra foramen, ipso contagio ipsaque materie continuatione. Certe ego talem adhibeo hypothesin in Dissertatione de motu undulationis, quæ est sexta pars meorum Mechanicorum; ut ponam, colores istos apparentes fieri ex sola illa Communicatione motionis, quæ ab Undulationibus directè procedentibus ad latera effundatur: Ut, si radii



intrantes per foramen a progrediantur versùs b, undulationes quidem directè terminari deberent (habendo rationem ad motum rectum & naturalem) ad lineam rectam a b; nihilominus tamen, propter continuitatem materie, fit aliqua communicatio commotionis versùs latera c c, ubi tremula quædam & crispans successio excitatur: Atque si in illa laterali crispatione consistere colores supponatur, existimo omnia phenomena colorum explicari posse, ut fusiùs in ea, quam dixi, Dissertatione expono. Quibus item positis apparet etiam, cur ultra quàm ferat radiorum ipsorum divariatio, expandi colorum latitudinem necesse sit. Verùm ista obiter hîc tantum adnotasse sufficiat.

Quid

Quod annotat, errorem, qui oriri posset in calculo, ex eo, quod dixeram, veluti foramine facto in posteriori facie prismatis; errorem, inquam, illum non posse inducere sensibilem varietatem: id optimè annotatum est; neque ego existimavi, inde multum augeri colorum latitudinem, sed tantummodo accuratam calculi rationem indicare volui: Quapropter etiam & ego in praxi negligendam hanc cautionem censeo.

Circa Experimentum crucis, nequaquam dubito, quo minus in suo experimento talem situm adhibuerit, in quo æqualis inclinatio fuerit Radiorum incidentium; quandoquidem id ita à se præstitum expressè affirmat. Verùm id non ego peteram conijcere ex iis quæ in Transactionibus legeram; ubi ponuntur duo exigua & maximè distantia foramina, & unum Prisma prope primum foramen quod est in fenestra; per quod Prisma radij colorati erumpentes incidunt in alterum distans foramen. Addebatur autem, quòd ad hoc ut omnes illi radii successivè inciderent in secundum illud foramen, convertebatur primum Prisma supra axem: Atqui hoc modo necesse est mutari inclinationem radiorum qui incidunt in secundum foramen: atque indicavi ego in literis, quòd perinde se se res haberet, sive manente primo Prismate immobili, secundum foramen attolleretur aut deprimeretur, ut posset successivè radios omnes depictæ imaginis Solaris excipere; sive manente isto secundo foramine immobili, primum prisma converteretur, ut ita eadem imago situm mutaret, atque in foramen impingere secundum omnes successivè partes posset. Sed alias sine dubio adhibuit cautiones solertissimus Newtonus.

Quæ circa Colores objeceram, optimè soluta existimo. Quod autem Theoriam istam, appellarim Hypothesin, id certè ego nullo adhibito consilio feci; atque nomen usurpavi quod primum occurrit: quapropter velim ut ne per contemptum adhibitam vocem ejusmodi existimet. Praclara sanè inventa semper ego magni feci, Clarissimum verò Newtonum imprimis suspicio ac veneror.

Mr. Newtons Answer to the foregoing Letter.

IN Observationibus R. Patris J. Pardies, quas ad te denuò conscripsit, an majus sit Humanitatis argumentum quòd meis responsionibus vim omnem attribuit; an Ingenii, quòd Objectiones proponit, quæ, si non probe tollantur, Doctrinam nostram frustrari possint, vix dixerim. Utramque sanè ad determinandam veritatem optimè conducit, efficitque ut acceptis quàm lubentissimè respondeam.

Ait R. P. quòd absque varia diversorum radiorum refrangibilitate possibile sit explicare longitudinem colorum; puta ex Hypothesi P. Grimaldi, per diffusionem luminis, quod supponitur esse substantia quedam rapidissimè mota; vel ex Hypothesi Hookii nostri, per diffusionem vel expansionem Undulationum, quas statuit in æthere à lucidis corporibus excitatas quaquaversum propagari. Addo, quòd ex Hypothesi Cartesiana potest etiam effingi consimilis diffusio conatus vel pressionis globulorum, perinde ut in explicatione Caudæ Cometæ supponitur. Et eadem diffusio vel expansio juxta aliam quamvis Hypothesin, in qua lumen statuitur esse vis, actio, qualitas, vel substantia qualibet à luminosis corporibus undique emissæ, effingi potest.

Ut his respondeam, animadvertendum est, quòd Doctrina illa, quam de Refractione & Coloribus explicui, in quibusdam Lucis Proprietatibus solummodo constitit, neglectis Hypothesibus per quas Proprietates illæ explicari debent. Optimus enim & tutissimus philosophandi modus videtur, ut imprimis rerum proprietates diligenter inquiramus, & per experimenta stabiliamus; ac dein tardius contendamus ad Hypotheses pro earum explicatione. Nam Hypotheses ad explicandas rerum proprietates tantum accommodari debent, & non ad determinandas usurpari, nisi quatenus experimenta subministrare possint. Et si quis ex sola Hypothesium possibilitate de veritate rerum conjecturam faciat, non video quo pacto quicquam certi in ulla scientia determinare possit; siquidem alias atque alias Hypotheses semper liceat excogitare, quæ novas difficultates suppeditare videbuntur. Quamobrem ab Hypothesium contemplatione, tanquam improprio argumentandi loco, hîc abstinendum esse censui, & vim Objectionis abstrahendam, ut pleniorẽ & magis generalem responsionem accipiat.

Itaque per Lumen intelligo quolibet Ens vel entis potestatem (sive sit substantia, sive quævis ejus vis, actio, vel qualitas) quod à corpore lucido rectà pergens aptum sit ad excitandam visionem; & per radios Luminis intelligo minimas vel quaslibet indefinitè parvas ejus partes, quæ ab invicem non dependent; quales sunt illi omnes radii, quos lucentia corpora vel simul vel successivè secundum rectas lineas emittunt. Nam ille tum collaterales tum successiva partes luminis sunt independentes; siquidem una absque aliis intercipi possint, & in quaslibet plagas seorsim reflecti vel refringi. Et hoc præcognito, Objectionis vis omnis in eo sita erit; Quòd colores per aliquam Luminis ultra foramen diffusionem, quæ non oritur ab in-

quali

quali diversorum radiorum (seu luminis independentium partium) refrangibilitate, in longum diduci possint.

Quod autem non aliunde oblongentur, monstravi in Literis relatis in Phil. Transactionibus, Num. 80. Et ut rationes facilius percipiantur, non gravabor jam fusius explicare.

Scilicet ex observatione, quod radii post refractionem non incurvabantur, sed rectâ ad parietem progressi fuere, patuit, eandem fuisse eorum ad se mutuò inclinationem cum modò exierunt Prismate, atque cum impegerunt in parietem; & proinde Longitudo colorum ex inclinatione radiorum emerfit quam inter refringendum obtinere, hoc est, ex quantitate refractionis quam singuli radii in Prismate patiebantur: Adeoque cum colorum longitudo latitudinem aliquot vicibus ex observatione superavit, sequitur, majorem fuisse inaequalitatem refractionum quam potuit oriri ex inaequalitate incidentiarum. Quin imò ex figura imaginis coloratæ, quod nempe non fuit Ovalis, sed ad latera duabus parallelis rectis lineis terminata, patuit, eam ex indefinitè multis imaginibus Solis, per inaequalem refractionem in longum distractis, & serie continuâ dispositis, constitui; adeoque radios à singulis partibus solaris Disci provenientes per totam ferè longitudinem colorum dispergi; & proinde similiter incidentium inaequales esse refractiones. Id quod aliis etiam indicis ostendi posset.

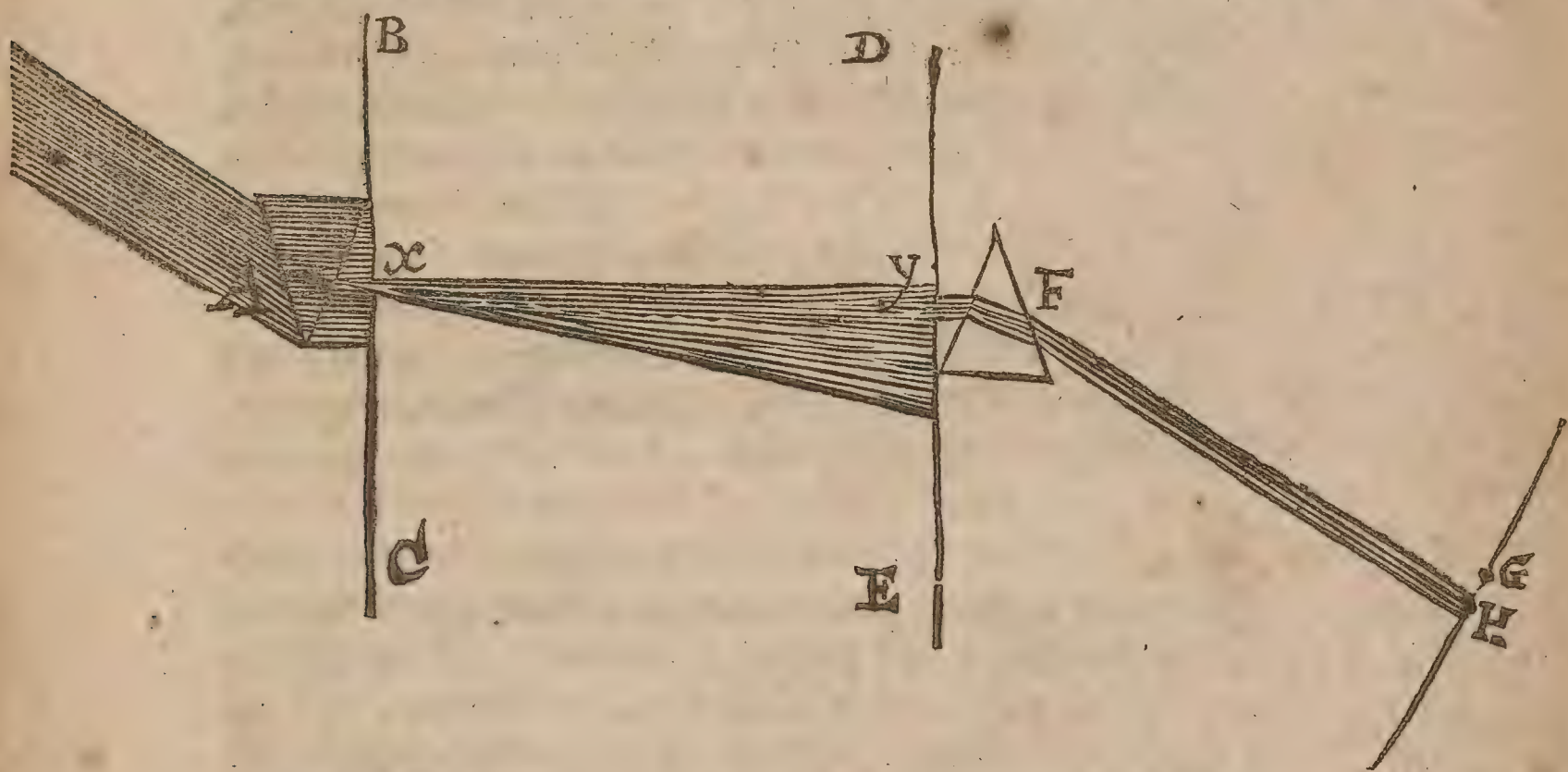
Constat itaque diversas esse refractiones, ubi pares sunt incidentie. Sed amplius inquirendum est, Unde oriatur illa diversitas; An sit à causa aliqua incerta & irregulari, vel certâ lege, secundum quam radius quilibet aptus est determinatam aliquam refractionem pati. Per incertas & irregulares causas intellige asperitates in superficie, vel venas diversa densitatis in interiori parte vitri ex quo Prisma conflatur; item irregularem situm pororum, quos nonnulli ob luminis transmissionem directo tramite per vitrum omnifariam trajici statuunt; nec non tremores & inaequales commotiones partium ætheris, æris, vel vitri; radiorum in refringente superficie se mutuò fortasse comprimantium resulturam ab invicem; ejusdem cujusque radii divisionem ac dissipationem in partes divergentes, quas vel numero finitas vel indefinitè multas in superficie aliquâ continuatim jacentes imaginari liceat; vel quamvis aliam diffusionem & dilatationem Luminis quam possumus excogitare, non ortam ex diversa prædispositione cujusque radii ad refractionem, in certo aliquo & constanti gradu patiendam.

Quod autem diversa refractio non orta sit ex ullis ejusmodi causis incertis & irregularibus, probavi per Experimentum duorum consimilium Prismatum in contrario situ juxta-positorum, ita ut posterius contrariâ suâ refractione retro-flecteret radios, & sic regulares effectus prioris destrueret, sed per iteratas refractiones auget irregulares. Utpote si prius Prisma diffunderet ac divergere faceret parallelos radios; e.g. per asperam polituram, inaequabilem densitatem, aut irregularem situm pororum Prismatis; vel per tremulos motus partium ætheris, æris aut vitri; vel per dilatationem luminis propter partium ejus (i.e. radiorum) se mutuò comprimantium relaxationem versus adjacentia spatia, quæ vel nullo vel minus constipato lumine irradiantur;

vel

vel denique per cujusque radii dilatationem aut diffractionem in complures divergentes radios: tum sanè posterius Prisma magis diffunderet ac dissiparet radios per dictas irregularitates ætheris, æris, aut vitri, vel per iteratam dilatationem luminis à refringentis superficiei resistantia denuò constipati ac diffusi, vel etiam per cujusque radii à priori diffractione orti iteratam diffractionem ac divisionem in longè plures divergentes radios. Et sic Lumen magis dispergeretur per refractionem secundi Prismatis, & in parietem projectam Imaginem duplo longiorem minimum exhiberet, quàm per solam refractionem prioris Prismatis exhiberi potuisset. Quamobrem cum, experientiâ teste, refractione secundi Prismatis adeò non dispergat lumen ut contrahat & in pristinum statum reducat, efficiatque ut in forma Coni postea progrediatur, perinde ac si nullam omnino refractionem passum fuisset; concedendum est, Diffusionem Luminis, à refractione anterioris Prismatis effectam, non oriri ab aliqua prefatarum causarum, aut alia quavis irregularitate, sed diversæ refrangibilitati diversorum radiorum solummodo tribuendam esse; utpote quâ radius unusquisque, ex insita dispositione tantam refractionem in posteriori Prismate ac in priori passus, reducitur in parallelismum cum seipso; & sic omnes radii ad se mutuo easdem inclinationes resumunt quas ante refractiones habuere.

Demum, ut hæc omnia summè confirmarem, adjeci Experimentum illud quod jam nomine Crucis passim insignitur: de cujus conditionibus cum R. P. dubitaverit, placuit jam designare Schemate. Sit *BC* anterior tabula, cui Prisma *A* immediate præfigitur, sitque *DE* altera tabula, quasi duodecim pedibus abinde distans, cui suffigitur alterum Prisma *F*. Tabule autem ad *x* & *y* ita perforentur, ut aliquantulum lucis ab anteriori Prismate refractæ,



trajici possit per utrumque foramen ad secundum Prisma, inque eo denuò refringi. Jam Prisma antè circa axem reciproco motu convertatur, & colores in Tabulam posteriorem *DE* procidentes, per vices attollentur & deprimuntur, eoque pacto alius atque alius color successivè pro arbitrio trajici potest per foramen ejus *y* ad posterius Prisma, dum ceteri colores in Tabulam impingunt: Et videbis, radios diversis coloribus præditos diversam pati refractionem

nem in illo posteriori Prismate, ex eo quod ad diversa loca parietis vel cuiusvis obstaculi G H, pedibus aliquot ulterius remoti, allabentur; puta violacei radii ad H, rubri ad G, & intermedii ad loca intermedia: & tamen propter determinatam positionem foraminum necesse est ut similis sit incidentia radiorum cuiusque coloris per utrumque trajecti. Atque ita ex mensura constat radios, diversis coloribus affectos, habere diversas leges refractionum.

Sed suspicor unde adductus sit R. P. in dubitationem; nempe videtur collocasse primum Prisma A post Tabulam B C, atque ita convertendo circa Axem, verisimile est inclinationem radiorum qui interjacent foramina propter intermediam refractionem fuisse mutatam. At ex descriptione exposita in Phil.

Transactionibus debuit Tabula illa collocari post Prisma, ut radii inter foramina in directum jacerent, quemadmodum ex verbis; I took two Boards and placed one of them close behind the Prism at the Window *, constare potest. Et usus Experimenti idem innuit.

* Vid. Num. 80. p. 3078. quæ verba Latine ita sonant; Capiebam duas Tabulas ligneas, unamque earum immediate collocabam post Prisma ad fenestram.

Ex abundanti placet observare, quod in hac Experimento colorata Lux ob refractionem secundi Prismatis longe minus diffunditur ac divaricat, quam cum alba existit, adeo ut imago ad G vel H sit penè circularis; præsertim si Prismata statuuntur parallela & in contrario situ angulorum, prout in Schemate designantur. Quinetiam, si præterea diameter foraminis y aequet latitudinem colorum, nulla erit ejusdem colorate lucis in longum diffusio; sed imago, quæ à quopiam colore ad G vel H effingitur, (positis circularibus foraminibus, & refractione posterioris Prismatis non majori quàm prioris, radiisque ad obstaculum quàm proximè perpendicularibus,) erit planè circularis. Id quod arguit diffusionem, de qua supra egimus, non ex contagione vel continuitate materie undulantis aut celerrimè mota vel similibus causis ortam esse, sed ex certa refractionum cuiusque generis radiorum lege. Cur autem Imago illa in uno casu sit circularis, & in aliis nonnihil oblongata, & quomodo diffusio lucis in longitudinem in quolibet casu pro arbitrio minui possit, à Geometris determinandum & cum experientia conferendum relinquo.

Postquam Proprietates Lucis his & similibus experimentis satis exploratæ fuerint, spectando radios tanquam ejus sive collaterales sive successivas partes, de quibus experti sumus per independentiam quod sint ab invicem distinctæ; Hypotheses exinde dijudicande sunt, & quæ non possunt conciliari rejciende. Sed levissimi negotii est, accommodare Hypotheses ad hanc Doctrinam. Nam si quis Hypothesin Cartesianam defendere velit, dicendum est, globulos esse inæquales; vel pressiones globulorum esse alias aliis fortiores, & inde diversimodè refrangibiles, & aptas ad excitandam sensationem diversorum colorum. Et sic juxta Hypothesin Cl. Hookii dicendum est, Undulationes ætheris esse alias majores sive crassiores aliis. Atque ita in cæteris. Hæc enim videtur esse summè necessaria Lex & Condicio Hypothesium, in quibus Naturalia corpora ponuntur constare ex quàm plurimis corpusculis acervatim contextis, ut à diversis lucentium corpusculis, vel ejusdem corpusculi diversis partibus (prout motu, figurâ, mole, aut aliis qualitatibus differunt) inæquales pressiones, motiones:

aut mota corpuscula per æthera quaquaversum traiciantur, ex quibus, confuse mistis, lux constitui supponetur. Et nihil durius esse potest in istis Hypothesibus quàm contraria suppositio.

Ex apertura sive dilatatione Lucis in posteriori facie Prismatis, quàm R. P. dixit esse veluti foramen, sufficit, quod error non emerget sensibilis si modò aliquis emergeret. Quòd si calculus juxta Observationes præcisè ineatur, error erit nullus. Nam diametro foraminis à longitudine Imaginis subductâ, restabit longitudo quàm Imago haberet si modò foramen ante Prisma esset indivisibile, idque non obstante præfatâ lucis dilatatione in posteriori facie Prismatis; ut facile ostenditur. Deinde ex data illa longitudine Imaginis, ac distantia à foramine indivisibili, ut & positione & forma Prismatis, & ad id inclinatione incidentium radiorum, ac angulo, quem refracti radii, ad medium Imaginis tendentes, cum à centro Solis incidentibus constituunt, cætera omnia determinantur. Et quæ determinant refractiones & positiones radiorum, sufficiunt ad calculum istarum refractionum ritè ineundum. Sed res non tanti esse videtur ut moram inferat.

Quòd R. P. Doctrinam nostram Hypothesin vocaverit, non aliunde factum esse credo quàm quòd vocabulum usurpavit quod primum occurrit; siquidem mos obtinuit ut quicquid exponitur in Philosophia dicatur Hypothesis. Et ego sane non alio consilio vocabulum istud reprehendi quàm ut nè invalesceret appellatio quæ rectè Philosophantibus præjudicio esse posset. R. Patris verò candor in omnibus conspicitur; indeque modus efferendi Benevolentiam, qui mihi minimè convenit. Quod tamen nostra non displicent, vehementer gaudeo. Vale. Dab. Cantabrig. 11^{mo} Junii 1672.

Hæc responsio ad R. P. Ignatium Pardies mox transmissa id effecit, ut ille die 9. Julii 1672. rescriberet Gallicè in hunc sensum;

Omnino mihi satisfecit novissima responsio, à Dn. Newtono ad meas Instantias data. Novissimus scrupulus, qui mihi hærebat circa Experimentum Crucis, penitus fuit exemptus. Atque nunc planè ex Figura ipsius intelligo quod non intellexeram ante. Experimentum peractum cum fuerit isto modo, nil habeo quod in eo desiderem amplius. Rem mihi pergratam feceris, si ipsi singularem meum ingenii & doctrinæ ejus cultum contesteris, & pro illo studio maximas gratias agas, quo voluit Annotationes meas examinare iisque respondere. Præter estimationem illam, quam jam ante de acumine ejus conceperam, affectus hic officiosus magnopere me ipsi devinxit.

An Account of some Books.

I. *SCARBROUGH SPAW* Spagyrically Anatomized, An. 1670;
And a NEW-YEARS-GULF for Dr. Witty; London 1671:
 Both in 12^o. by George Tonstal Doct. of Physick.

THE Examination of Medical waters being so useful both for the improvement of Physiology, and the Relief of the Health of man; we cannot but take publick notice in these Tracts of the discourses of that Subject, that come abroad by the Press; wishing only, that the Examiners of such matters, as well as of all others, would consider them without partiality and invectives, with all possible care and sincerity; thereby to stock the Philosophical Magazeen, that is now every where a furnishing by Experimental Philosophers, with such observations as commend themselves by their Truth and Exactness: For the finding out of which in the matter of the *Scarborough Spaw*, treated of in these two pieces, and controverted between their Author and Dr. Witty; it seems to be very necessary to commit the examination of what they both have deliver'd thereon to some as well impartial as intelligent Naturalists, to review what they have written, and to repeat the Trials they have made, the better to enable themselves to decide the dispute.

In the mean time it may not be amiss to give some account here both of the state of the Controversy, as 'tis delivered in these two discourses, and of the Assertions made by Dr. Tonstal concerning these waters.

The Controversy is, whether the *Scarborough-Spaw* do contain for Ingredients, *Particles of Stone*, a *Nitro-aluminous Salt*, and a *Glebe of Allom*; and consequently be apt, upon the account of that *Stone-Powder* and clay, to breed the Stone? This is denied by Dr. Witty, who judgeth its material principles to be chiefly, *Allom. Nitre*, and *Vitriol of Iron*, which he saith he hath extracted out of it. Whereas Dr. Tonstal positively affirms, that the *Scarborough-water* hath no vitriol or iron in it, but a *Stone-powder*, and a clay, leaving sand at the bottom of the

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Vessel

Vessel, when it is boiled, like the dropping well at *Knaishorough*; and that consequently it hath a Lapidescient Juice, and therefore is petrifying, and bad for the Stone, Gout, and Jaundice: maintaining, that that which Dr. *Witty* calls a little insipid earth, (remaining upon the dissolution of the first extract of this Spaw, and the filtration of it) is a great deal of gretty Stone-powder; and adding further, that 'tis the peculiar Character of the same Spaw, whereby it is distinguish'd from other Spaws in use, to take a resty fit sooner or later, so as that it will neither go backward nor forward, by siege or urine.

Having made it his business to prove this both by a Chymical Analysis, and by Experience of his own and others, importing that they never had any fit of the Stone till he and they drank of this *Scarborough*-water; he further observeth,

1. That *Allom-Stone* dissolved in water yields a Purple tincture by *Gall*; and that, this *Allom-stone* being acknowledged by Dr. *Witty* to be in *Scarborough*, therefore the Tincture by *Gall* is no argument for *Vitriol* in that Spaw.

2. That all waters that have dissolved Iron, have *Vitriol* also as the product of that dissolution.

3. That all the Salt that sprouts out of the *Scarborough*-cliff, is Nitro-alluminous, and not *Vitriol*.

4. That the precipitated powder found at the bottom of the vessel, after that *Scarborough*-water hath stood in it two or three dayes, is Glebe of *Allom*.

5. That if *Vitriol* be joyned with *Niter* in *Scarborough* (as Dr. *Witty* will have it) it becomes a corrosive water, whereby (saith Dr. *Tonstal*) it would be made worse than by all he hath written against it.

Whilst our Author is thus examining the *Scarborough*-Spaw, he taketh occasion to say thus much of that of *Knaishorough*, that its worth and excellency is, that an Embryonate Sulphur hath corroded Iron in it; which, saith he, makes it Stomachical, Opening, Diuretical, and strengthening all the noble parts.

Having thus represented the sum and substance of what Dr. *Tonstal* hath alledged against Dr. *Witty* upon this Spaw; we wish for further examination of this water, to be undertaken

taken in an amicable and unbiaſſed way, and by the conjunction of ſome able and diſcreet Perſons with theſe two diſputants, that have hitherto very unbecommingly inveighed againſt one another.

II. *NEW-ENGLANDS RARITIES* discover'd; together with the Remedies uſed by the Natives to cure their Diſeaſes, Wounds and Sores, &c. By John Joffelin Gent. London 1672. in 12^o.

THeſe Obſervations are the fruits of the Authors eight years travel in *New-England*: They concern (beſides the Geography of that Country, and the temperature of the Air, and the moſt common Diſeaſes) the natural Productions of that Engliſh Plantation: And thoſe 1 *Animals*; viz. Birds, Beaſts, Fiſhes, Serpents, Inſects. 2 *Plants*, and theſe either ſuch as are common with us; or proper to that Country, both with, and without names; or ſuch as have ſprung up ſince the *Engliſh* planted there; or laſtly ſuch Garden-herbs (amongſt us,) as do thrive there, and of ſuch as do not. 3. *Foſſils*, as Stones, Minerals, Metals, and Earths.

To make theſe Obſervations of Nature the more conſiderable and uſeful, the Obſerver ſubjoins to them their reſpective uſes in Phyſick, Chirurgery, Dying, &c. e. g. To cure conſumptions by eating *Land-Turtles*: To heal Scalds and Burns with the Oyl of the *Sea-Calf*; or with a ſtrong decoction of *Tobacco*, waſhing the Sore therewith, and ſtrewing *Tobacco-powder* thereon: To heal Bruiſes and Aches with the Oyl of the *Sperma-ceti-Whale*; which, ſaith the Author, being put up into Hogſheads, and ſtow'd into Cellars for ſome time, candieth at the bottom about one quarter, and then the oyl being drawn off of the candied ſtuff, put up into convenient veſſels, proveth to be right *Sperma-Ceti*, and is ſold for ſuch, being admirable for the already mention'd uſes: *Item*, To remedy the biting of a Rattle-Snake by bruizing its Liver and applying it to the wound: To ſtrengthen the Limbs by anointing them with an Oyl, drawn out of the white Oak acorns, boiled in a *Lixivium* made of the Aſhes of rotten Maple-wood, untill the Oyl ſwim on the top, which is ſo clear and ſweet, that the *Indi-*

and eat it also with their meat: To heal bruised Limbs and Cuts with the bark of Birch, boyled very tender, and stamped between two Stones to be a plaister, and the decoction thereof powred into the wound: To take off a Pin or web, or any kind of film growing over the eye with the calcin'd and pulverized shell of a *Sheath-fish*, which is very plentiful in *New-England*; a delicate fish, cover'd with a thin shell and of the colour of a Musle.

Among the *Animals*, there are some that deserve to be taken notice of above the rest; as 1. A *Dear*, call'd the *Moose-dear*, some of which are described to be twelve foot high, with exceeding fair Horns with broad palms; some of them two fathoms from the tip of one Horn to the other: They have commonly three *Fawns* at a time, which are, to our Observers Palate, an incomparable dish. 2. A monstrous great Bird, call'd *Pilhannaw* or *Mechquan*, a kind of Hawk, four times as big as a *Gos Hawk*, with a head as big as a Childs of a year old, a very Princely Bird; at whose soaring abroad, all sorts of feather'd creatures hide themselves; though she never preys upon any of them, but doth upon *Fawns* and *Jaccals*. 3. The *Scarlet-Musle*, having a purple-vein, which being prick't with a needle yeilds a perfect Purple or Scarlet Juyce that will not be washt out of the Linnen died therewith; found at *Paschatamey*, a Plantation about 50 Leagues by Sea East-ward from *Boston*, in a small Cove, call'd *Bakers Cove*. 4. A little Beast call'd a *Muskquash*, feeding upon the bastard *Calamus Aromaticus*, hath Cods senting that as sweet and strong as Musk, and lasting thus a long time, wrapt up in Cotton-wool.

Among *Plants* there is one, taken by some to be a kind of *Golden-Rod*, by others for *Sarazens Confound*, by the Author for a kind of *Sun-flower*, or West-Indian *Marigold*; of which the stalk beneath and above the knob is cover'd with a multitude of small Bugs, about the bickness of a great Flea, which order'd as they should be before they come to have wings, the Observer presumes will make good *Cochineel*; they yeilding a perfect and durable Scarlet-colour.

The *New England Pease* are said by our Author not only to be the best in the world, but free from being worm-eaten.

Rue he noteth for an herbe hardly growing there; *Rose-Mary*, *Lavender*, *Southern-wood*, not at all; *Blood-wort* and *Celandine*, but sorrily; *Musk-melons* better than in old England, &c.

III. *A Rational way of preparing ANIMALS, VEGETABLES and MINERALS for a Physicall use: by Edw. Boerhaave Med. Reg. Ord. London, 1672. in 12.*

THis Author, having some years since in his *Medicina Instaurata* given a brief accompt of the Excellency of well-prepared Chymical Medicines, with the reasons why they were and ought to be esteemed such; did then promise this Piece, wherein he undertakes to teach the *Manner* of their Preparation, by which he esteems they are made most efficacious, safe and pleasant Medicines for the preservation and restoration of the Life of man. In the doing of which, he giveth both general instructions, and particular Examples in each kind, and of each Kingdome, as they speak; which though not many, yet are by him conceived as sufficient guides to a larger progress.

He begins with the general way of preparing *Animals* into a true medicine; and then descending to the preparation of a particular Animal, he would have Students of Chymistry consider, what vertues Physicians have adscribed to it, together with its dose according to occasion, and the strength, age, and constitution of the Patient, and a fit vehicle. It were to be wished, that since this Author often speaketh of the *Fixed Salt* drawn from Animals, he had obliged the curious Reader with specifying, what quantity of such Salt he had by his own Operations obtained from Animals.

He proceeds next to the manner of preparing *Vegetables*, observing, that in them lies hid a very subtil and pure æthereal, and a fixed substance, the cherisher and supporter of life, the food and nourishment of natural heat, the root and foundation of all its faculties: which substances whilst they are abounding, trees flourish and bring forth fruit; but once decaying, they grow unfruitful, wither and dye.

Lastly

Lastly, he teacheth his way of preparing *Metals* and *Minerals* for the health of man, assuring the ingenious Searcher after this knowledg, that he may with confidence have recourse to it, both for safety and efficacy, beyond the common Preparations now in use; and adding withall, that, because he knows many Practitioners may want either time or conveniency to provide themselves with such Medicines, he promises herewith, that he will, upon their desire, spare them such Medicines as he hath prepared for his own use, *whether* of the more common preparations but better elaborated, or other particular remedies; and that, upon a friendly account, the Medicine rightly considered: Declaring moreover his willingness to afford any Learned Physitian the satisfaction of seeing his Laboratory, or the Preparation of any medicine he shall desire at seasonable times.

Here, when he treateth of the Preparation of *Mercury*, he intimates, that that being well perform'd it will yeild a Medicine much availeable in the cure of very many diseases, and that *citò, tutò, & jucundè*; whereas otherwise, if *Mercury* be only changed in form, it may, being imprudently and rashly used, do more hurt than good. Whereupon he sets down some of such Processes and preparations of this odd Metal, as he judgeth most safe, and fit for internal Medicines: Which seem to deserve the consideration of sober and intelligent Readers.

IV. *Miscellanea Curiosa PHYSICO-MEDICA Academiae Naturae Curiosorum: annus secundus, anni sc. 1671. Jenæ 1671. in 4º.*

AS there was given an Account in N°. 68. of the first Years Philosophical *Ephemerides* of the German Academy of the Curious Inquirers into Nature; so we shall here give notice, that the same Academists have made publick their Collections of the *second* year, falling into 1671; In which amongst many other particulars there are contained these following;

1. A dissection of a Lyons, and a Tyger.
2. Several odd peculiarities of Nature,

3. A singular Case of a German Countess, alwaies voiding *aquam-puerperii* fifteen daies before she brings forth a Son, but not when a Daughter.

4. An odd generation of worms in the Eye-lids, and the cavities of the Ears.

5. A dissection of an Infant destitute of all Brain.

6. A Preparation of Volatile Salt of Tartar.

7. *Napellus* not poysonous in Poland.

8. A dissection of a Mole and an Hedge-Hog.

9. A Belly altogether grown scirrous.

10. A dissection of an Epileptical young man, and the Observables found in his Head, and the other parts of his body.

11. An uncommon History of Stones taken out of the feet of Podagrical persons.

12. Of a Woman having three Breasts.

13. Respiration considered Mathematically.

14. A Perlustation of the chief Mines in *Bohemia*, especially of *Cuttenberg*, *Joachims-daal*, the *Beauteous Mary*, *Slackenwald* and *Schonfeld*: In which there are, respectively, Mines, of Silver mixt with Copper; a considerable Silver-mine called the Mine of *New Hope*, newly discovered: Mines of Bel-metal; of Bismuth; of meer Silver; &c. together with divers considerable Observations of the face, constitution, and external productions of those and their neighbouring places; as also of a notable substance, call'd *saxi Medulla*; of an highly valued Black Earth; of abundance of Granats growing there; of a whole Tree petryfied; of very pernicious damps; of pretended sub-terraneous Dæmons; &c.

15. Another preparation of Volatil Salt of Tartar.

16. A wound of the Eye strangely cured.

17. Instances of the strange force of Imagination.

18. An odd Antipathy to Bread.

19. An Example of an Anniversary Melancholy.

20. A verminous Tertian Ague.

21. Some Anatomical Observations upon Animals.

22. A dissection of a Woman that had voided unusual things.

23. Di-

23. Divers Experiments about Congelation.
24. An Hermaphroditical conception.
25. A strang Birth of a putrified Embrio.
26. A very odd kind of Convulsions.
27. An admirable cure of a very grievous wound in the Head, with the loss of part of the Brain.
28. A dissection of a man that died of a Consumption, and of another, that died of the Stone.
26. A *Castor* dissected, &c.

For the rest we must refer to the Book it self, (to be met with at Mr. *Martyns* in St. Pauls Church-yard ;) after we have only intimated , that these Observations amount to 260 ; whereof many are illustrated with elegant Cuts.

Errata.

There was a mistake left uncorrected in N°. 81. p. 4021. l. 17 where, instead of *iræ*, is to be read, *libidinis*.

In N°. 82. p. 4036. l. 27. r. distitit 21'. 50'. p. 4037. l. 23. r. alto 4 29°, 35'.

LONDON,

Printed for John Martyn, Printer to the Royal Society, 1672.

PHILOSOPHICAL TRANSACTIONS.

August 19. 1672.

The CONTENTS.

An Extract of a Letter of M. Hugen, attempting to render the Cause of that odd Phænomenon of the Quicksilvers remaining suspended far above the Usual height in the Torricellian Experiment. An Extract of Mr. Templers Letter concerning the Structure of the Lungs. Some Astronomical Observations, made by Mr. Flamsteed; viz. an Appulse of the Moon to the Pleiades; a regress of Jupiter to the Fixt Star of Ω ; a passage of Mars near a Fixt Star in π : And one to be made, concerning a Transit of the Planet Mars near three Fixt Stars in χ . An accurate Description of the Lake of Geneva by a late curious Observer. An Accompt of some Books: I. LUX MATHEMATICA, Collisionibus Johannis Wallisii & Thomæ Hobbesii excussa, &c. II. OPTIQUE de PORTRAITURE & PEINTURE; par Gregoire Huret. III. Christiani Frider. Garmanni HOMO EX OVO. IV. A short and sure Guide in the Practise of Raising and Ordering of FRUIT-TREES; by Francis Drope. An Advertisement.

An Extract of a Letter of M. Hugen to the Author of the Journal des Scavans of July 25. 1672. attempting to render the Cause of that odd Phænomenon of the Quicksilvers remaining suspended far above the usual height in the Torricellian Experiment.

THE Experiment is briefly this; That a Tube, being, after the Torricellian way, filled with Mercury, and before inversion perfectly purged of Air, doth, when inverted,

C c c c c

remain

remain top full, even to the height of 75 inches.

M. *Hugens*, to render a probable cause of this strange effect, conceiveth, That, besides the pressure of the Air, which keeps the Mercury suspended at the height of about 27 inches, and of the truth of which we are convinced by a great number of other effects that we see; there is yet another pressure, stronger than that, of a more subtile matter than Air, which without difficulty penetrates glass, water, quicksilver, and all other bodies, which we find impenetrable to Air. This pressure, *he saith*, being added to that of the Air, is capable to sustain the 75 inches of Mercury, and possibly more, as long as it works only against the lower surface, or against that of the Mercury, in which stands the open end of the tube: But as soon as it can work also on the other side, (which happens when striking or hitting against the tube, or intromitting into it a small bubble of Air, you give way to this matter to begin to act) the pressure of it becoms equal on both sides, so that there is no more but the pressure of the Air, which sustains the Mercury at the ordinary height of 27 inches.

If you ask, why the Quicksilver in the Tube of this Experiment does not feel the pressure of this matter, even whilst that vessel is yet full; since M. *Hugens* supposeth, that it pierceth without difficulty the Glass as well as the Mercury, &c? And why the particles of this matter do not joyn together and begin the pressure, in regard that they go and come thorow the whole extent of the Mercury, and that the Glass does not hinder their communication with those that are without:

To remove this difficulty, which in M. *Hugen's* own opinion is very great, he answers, That though the parts of the matter, by him supposed, do find passage between those that compose the glass, quicksilver, &c; yet they there find not sufficiently large ones for many to pass together, nor to move there with that force which is requisite to separate the parts of the quicksilver, that have some connexion together; And this very same connexion, *he saith*, is the cause, that though on the side of the inner surface of the glass, which touches the suspended Mercury, many of its parts be pressed by the particles of this matter: yet there being also a great number of them, that feel no pressure by reason of the parts of the glass,

glass, behind which they are placed; they retain one another, and they remain all suspended, because there is much less pressure on the surface of the quicksilver that is contiguous to the glass, than upon that below, which is all exposed to the action of that matter which makes this second pressure.

The ingenious and candid Author of this solution acknowledges himself, that it doth not so fully satisfy him as not to leave some scruple behind; but then he adds, that that keeps him not from being very well assured of that new pressure, which he hath supposed besides that of the Air, by reason as well of the Experiment already alledged, as of two others, which he subjoins to this effect;

First, When two plates of mettall or marble, whose surfaces are perfectly plain, are put one upon another, they do so stick together, that the uppermost being lifted up, the undermost follows without quitting it: And the cause hereof is justly adscribed to the pressure of the Air against their two external surfaces. He taking then two plates, each of them but about an inch square, being of that matter, of which anciently they made Looking-glasses, and closing so exactly together, that without putting any thing between, the uppermost keeps not only up the other, but sometimes also with it three pounds of lead fasten'd to the lowermost, and thus they remain together as long as you please. Having thus joyned them and charged them with three pounds weight, he suspended them in the Recipient of his Engin, and exhausted it of Air so far as that there remained not enough to sustain by its pressure as much as an inch high of water; and yet his plates disjoyned not. He adds, that he made the same Experiment by putting Spirit of Wine between the two plates; and found, that in the Recipient evacuated of Air they sustain'd, without being sever'd, the same weight they did when it was full of Air. This, he thinks, shews clearly enough, that there remains yet in the Recipient a pressure great enough after that of the Air is thence taken away; and that there is no more reason to doubt of it, than of the pressure of the Air it self.

The *Second* Experiment is, That whereas the effect of a siphon of unequal legs, by which you make the water of a vessel to run over, is no longer adscribed to a *fuga vacui*, but

to the weight of the Air, which pressing upon the water of the vessel makes it rise in the siphon, whilst on the other side it descends by its weight; *M. Hugen*s found a means to make the water of the siphon run, after that the Recipient was exhausted of Air, and he saw, that with Water

* *M. Hugen*s hath made the Experiment, the Cause of which is here considered, as well with Water as with Mercury.

purged of Air* it did the effect as well as without the Recipient. The shortest of the legs of the siphon was eight inches long, and its aperture, of two lines. And he will not have us doubt, whether the Recipient was well exhausted of Air; for he did assure himself of that, as well by finding that there came out no more Air through the pump, as by other more certain marques.

And this he takes for a further confirmation of his supposition of a pressing matter more subtile than the Air. To which he adds, that, if you take the pains of searching, to what degree the force of this pressure reacheth, (which he saith cannot be better made than by pursuing the Experiment with Tubes full of Mercury yet longer than those employ'd by *M. Boyle*,) it will perhaps be found, that this force is great enough to cause the *Union* of the parts of Glass and of other sorts of bodies, which hold too well together as not to be conjoyned but by their contiguity and rest, as *M. Des:Cartes* would have it.

An Extract of Mr. John Templers Letter of March 30. 1672. to Dr. Walter Needham concerning the Structure of the Lungs.

— IN Answer to the request of an Ingenious Dr. of Physick I was lately engaged to give my thoughts of the Structure of the Lungs; which was as follows.

I have formerly fancied, the Lungs to be composed of a multitude of vesicles: Into which opinion I was persuaded by inflation into the *Aspera arteria* of Fowls; and observing the continuation of many vesicles extended from the *bronchie* thorough the *abdomen* to the *anus*, (which I conceive to be the cause of the constant motion of the *anus* in fowls; the Air having ingress and egress there; and also that to be the reason why the *anus*'s of fowls are in malignant distempers applied to draw the infection out of the body *:) I thence conjectured, the substance of the Lungs to be a Complication of a multitude of vesicles with the sanguineous vessels. And in this opinion I thought myself confirmed by blowing into the *Aspera arteria* of Quadrupeds, when I had cut off part of the exterior membrane of one lobe of the Lungs, and found the Lungs to rise with unequal protuberances not unlike bladders.

* Those *anus*'s being like Cups or Ventouses, and the fowl having often stuck by its *anus* till it died; in which case the Author of this Letter affirms to have known seven chickens applied to the groin of one visited by the plague, that stuck till they died, and the eight went quickly off, and lived above $1\frac{1}{2}$ year after.

But this second contrivance, which I am going to describe to you, hath much shaken that conjecture.

March 2. 16 $\frac{71}{72}$, I made a ligature about a Dogs neck, and opening both the Jugular veins with a pretty large orifice, I let him bleed to death, (using this way to prevent being overcharged either with any quantity of blood or with blood coagulated; both which would have been hazarded, in case I had either strangled the dog, or cut one or both of the Jugulars asunder:) Immediately I open'd the *thorax*, and tying the *vena cava*, with all the passages from the left ventricle of the Heart, or its *auricula*, I cut the Lungs with the Heart and *Aspera arteria* entirely out. To the *Aspera arteria* I fitted a syphon, long seven inches; which I thrust two inches in length into

into the said artery, and fastned it with a strong binding of pack-thread. This done, I blew up the Lungs, and fitting a cork to the end of the syphon, I hung them in a chimney to dry. In a quarter of an hour they subsided about a sixth part; whereupon I order'd a person to watch them, and to blow them up as oft as they subsided. Which course continued, they would not the next morning subside a fourth part in three hours. And (excepting three quarters of an inch distance from the circumference of the lobes, where the thinness of the substance of the Lungs gave the external heat the advantage of a sudden passage, and quick dispatch of drying those parts least furnish'd with moisture,) I did not perceive, making a proportionable allowance for the drying of the whole substance of the Lungs, any considerable subsiding in two days more. But upon the blowing in at the syphon (whose ligature I was now forced to renew,) I could easily feel the Air to pass through the external membranes, both on the convex and concave sides, towards the extremity of the circumference of the lobes; but most abundantly on the concave side.

March 5th, I carefully cut off one of the lobes, and the inward structure seemed like a cane or dried flag when transversely cut; and, upon blowing in at the syphon, I fancied the Air to come equally out at all the pores I had exposed to view. Whereupon I fixed spittle in several places, and upon fresh blowing found multitudes of bubbles, made in the denudated parts of the lobe. Immediately I made a deep transverse incision into that lobe, and blowing in at the syphon, I found the Air to come so freely out at the larger ramifications of the *bronchiæ*, that I could not give the lobe a considerable rise with a strong blast: Yet upon stopping with my fingers the larger passages of the *bronchiæ*, which I had cut, I found that lobe, upon a fresh blast, considerably to arise with unequal protuberances (where the incision was made,) giving no small suspicion of some latent vesicles. Hereupon I tyed that lobe above the incision, and taking off part of the external membrane of another lobe, (having first tyed up all the rest of the lobes,) I poured water into the syphon, and applied a strong blast, in hopes to have the water come forth in streams at all

the pores; but that did not satisfactorily succeed, it coming out in a confused irroration of the external surface, without any ebullition, unless at the larger ramification of the *bronchiæ*. Then I tyed up this second lobe, and untied a third, pouring in an ounce of the oyl of turpentine; at the syphon I gave a small blast, and corked it up. Two hours after I took off the small membrane of that lobe, and upon a gentle blast at the syphon found an ebullition of infinite little bubbles.

March 10th (having continued it to the chimney,) I cut all the lobes in pieces by different and various irregular incisions; whence I could easily observe the several ramifications of the aerial and sanguineous vessels, with their continuation to the circumference of the lobes, and a proportionable diminution as they were at a further distance from their original.

Shall I hence conclude the Structure of the Lungs to be a Complication of a multitude of the Ramifications of the *bronchiæ* and sanguineous vessels? And that the seeming vesicles were occasion'd only by the violence of the blast, and the driness of the extreme and smallest passages of the Aerial vessels; whereupon those, nearest to the *bronchiæ* (being moister,) were, more than their ordinary proportion, extended, upon hindrance of a free and usual passage to the Air in the lesser vessels or their extremities?

These cases I leave, with the manner of the Air's being commixt with the blood in the Lungs (which I think no hard matter plainly to discover,) to the *Virtuosi* of our Age, who have infinitely more advantages for the discovery of Nature's works, and to whom I cannot imagine this scribe to be any novelty. In which uncertainty I leave it to your discretion to do with it as you please.

Some Astronomical Observations in part already made,
partly to be made.

1. Lunæ ad Pleiadas Appulsus A. 1672. Februar. 23. st. v. Observatus Derbyæ Anglorum à Johanne Flamstedio.

Altâ Lunâ $20^{\circ}.50'$. cepi ipsius Diametram $32'.48''$; & altâ ipsâ $19^{\circ}.23'$. rursus eam cepi, $32'.47''$. Ergo Luna in Horizonte Semi-diameter erat vera $16'.19''$. Plus tamen etiamnum ab Occidentali stella Pleiadum absuit quàm commodè caperet Telescopium. At —

H. 11. $19^{\frac{1}{2}}$ p. m. altâ \star^b , occidentali Pleiadum $9^{\circ}.50'$; ejusdem stellæ distantiam cepi à cornu Lunæ proximo $11'.58''$. divertens deinde subito ad \star^x altitudinem (ostensam quadrante, 20 digitorum radio, ad Tubi latus affixo,) notandam, & continuo reversus, stellam (quippe tunc à Luna tectam,) non comperi. Interea Luna descenderat minuta 10, simulq; tandemdem Stella, quam subjisse Lunam h. 11. $20^{\frac{1}{2}}$ ex sequente phasi conjicio: Etenim

H. 11. $30^{\frac{1}{4}}$, altâ \star^c $8^{\circ}.43'$, Stellam c à Luna tectam conspexi: Ejus cum cepissem à cornu proximo distantiam $16'.35''$, spatium temporis inter hujus & precedentis occultationem, editis supputationibus constitui $9^{\circ}.37''$; quæ temperi hujus phaseos sublata, dant utique precedentis Occultationis tempus ut constitui.

H. 11. $37^{\frac{1}{2}}$, altâ \star^c $11^{\circ}.37^{\frac{1}{2}}$, ipsa Lunam subiit, me interea distantiam ejus dimetiente $22'.36''$. à cornu Lunæ apparenter inferiori, sed superiori verè. Deinde protinus vicinum ponè tectum Luna descendens, amplius hac vice æquavit à me observari. Erat, stellâ evanescente, Luna semidiameter apparens $16'.21''$. quæ propterea occultata erat $87^{\circ}.25'$. peripheria lunaris à cuspide superiori, cujus erat reclinatio (à linea per Centrum ejus, Ecliptica ducta perpendiculari) $1^{\circ}-37'$. Sic subingressus stellæ fuit $4^{\circ}.12'$. supra lineam per Centrum Lunæ Ecliptica ductam parallelam, & Lunæ centrum in antecedentia \star^x $16'-18''$. cum minori latitudine $1^{\circ}-12'$.

Fixæ locus Authori Carolino $8^{\circ}.25'.1'.24''$; latitudo perpetua $4^{\circ}.20'.39''$. quamobrem Lunæ locus apparens horâ apparenti Derbyæ 11 h— $37^{\frac{1}{2}}$. p. m. erat $8^{\circ}.24^{\circ}.45'.6''$. & latitudo visa $4^{\circ}-19'.27''$. Bor. Maturiores, semihorâ fere, apparentias supputationes nostra tabulis Carolinis promiserant, quarum ut certum à calis dissensum consequar, Lunæ locum ad hanc ultimam phasim ab iis eruo, nec non à Tabulis Bullialdi

Bullialdi Philolaicis, quas parum melius caelos affecutas comperio. Etenim
 Hora apparens Derbiæ 11^h. — 37'. 30". media erat Authori Carolino
 11^h. 34'. 51" ; sed Londini 11^h. — 39'. 51". Bullialdo tempus esset me-
 dium Derbiæ 11^h. — 46'. Uraniburgi 12^h. — 41'. unde motus ab illorum
 tabulis hi colliguntur ;

	Bullialdo.	Streetio.
Solis Anomalia media	8—6—45—29	8—6. 34—15
Locus verus	✕. 15—21—52	✕. 15—17. 21
Lune Anomalia media	5—21—36—13	5. 21. 38. 41
Distantia à ☉ 1° equata	2—9—40—29	2. 9—38. 15
Locus in Ecliptica	8.25—54.	8. 25—47. 48
Latitudo vera borea	4—59 ¹ / ₂	. 4—59—42.

Recta ascensio solis.	346.	28.
Temporis	174.	22.
Medii cœli	160.	50.
Medium cœli	✕ 9.	15.
Ejusdem declinatio	8.	6.
Altitudo	45.	9.
Horoscopus	✕ 18.	43.
Distantia medii Cœli ab Horoscopo	69.	28.
Angulus occidens	49.	12.
2 ^a distantia, secundum Eclipticam, Eclipti- calis ab horoscopo	7.	6.
In magno circulo	8.	40.
Altitudine		63. 10".
Parallaxis Lune in longitudine		47. 29.
Latitudine		41. 16.
Ergo Luna visa	8.25.	0. 0.
Cum latitudine Boreali	4.	18. 26.

Tabula propterea Carolinæ cœlos exsuperant longitudine 14'—53", à quibus latitudine deficiunt 1'—1". Etiam si in Eclipsi nâpera (Sept. $\frac{8}{18}$) cum iis quàm proximè conveniebant. Locus fixæ Philolaicus $\text{B. } 25^{\circ}. 4'$; Propterea tres tantum scrupulos minus quam Carolinæ, Bullialdi deviant tabulæ; quæ in eodem lunari deliquio 20'. 51" temporis cœlos anticipabant.

*Notatu præterea dignissimum, quòd, etiam si omnes ferè omnium Astro-
nomorum hypotheses, Luna plena Perigeæ in quadraturis majorem tri-
buant diametrum, & proinde minorem à terra distantiam quam in sy-
zygiis aut Oppositionibus Perigeis; Contrarium tamen cœlitus fieri &
evenire: Luna etenim plena Perigea transiens juxta Pleiadas Nov. 6.
1671. majorem habebat diametrum quàm in hoc transitu, quando in
eodem ferè loco à Sole distat gradus 70 Luna semidiameter horizontalis.*

Nov. 6. 1671. Bullialdo. 17'. 00"	Streetio 16 30	Observata 17. 00
Febr. 23. 1672. Bullialdo, 17—50	17. 13	16—19
<hr/>	<hr/>	<hr/>
+ 50	+ 43	—41

*Amplius non nunc miramur, Lunam tam diu numerorum recusasse vin-
culos, & de tabulis supputata apparentiarum tempora usque adeò ex-
pectationes nostras fefellisse; à falsis quandoquidem hypothesis ipsas
plerumque constructas fuisse liquet. At ubi nunc querenda Luna? Ver-
satis planetæ noster abiit, excessit; Et nulli numeri ductores, nulle
tabulæ, quæ non à suo cœlesti tramite nos deducant. Morandum pau-
lisper, donec accuratissimæ diametrorum observationes, commodissimis or-
bitæ locis habitæ, qualibus cieatur motibus, & quibus tandem legibus ij
motus sint obnoxii, aut quibus investigandi & coercendi numeris, osten-
derint.*

2. Jovis ad Fixam $\Omega^{\circ} 38$. Regressus, *Derbia* Anglorum observatus, *Maii* diebus 24. 26, 27, 28, & 30. *st. v. A. 1672.*
à *Joh. Flamstedio.*

Die ♀, *Maii* 24, alto φ $24^{\circ} - 10'$. hor. 10. 00'. humilior erat ejus centrum quàm stella, $7' - 46''$; à qua semel ejus cepi distantiam $20'. 0''$. & deinde $19'. 54''$. in antecedentia Fixa stabat.

Die ☉. 26. has habui, nec inaccuratas, Cælo sereno.

Alto φ	^{h.} 33—30=8—46	distantia centri φ^s à fixa	10-04. *
	31—50=9—00	fixa altior erat quàm φ	6-30
	29—10=9—20	altitudinum differentia erat	6-38 *
	27—20=9—33	differ. Azymuthorum φ^s & Fixa	7-19
	27—00=9—36	distantia φ^s à fixa denuò capta	10-02

Die ♃. 27. ventis interdum tubum moventibus, observabam

Alto φ	^{h.} 31—24=8—59	centri à fixa distantiam	6-02 *
	30—30=9—7	Azymuthorum differentiam	1-50
	29—13=9—16	eandem rursus differentiam	1-52 *
	28—10=9—23	centri φ^s à fixa distantiam	6-01

Die ♂. 28. ventis validè flantibus & Telescopium concutientibus notavi.

Alto φ	^{h.} 31—8=8—57	à fixa distantiam centri φ^s	6-02 *
	28—10=9—19	differentiam Azymuthorum centri, &c.	3-29
	26—30=9—31	isthanc differentiam rursus	3-32
	26—08=9—34	distantiam rursus	6-07

Die ♃. 30. alto φ $26^{\circ} - 15'$. hor. 9—36'. Cælo satis sereno & quieto, Jovis distantiam à fixa cepi $15' - 38''$. Hac & præcedente nocte in consequentia fixæ erat, antea semper in antecedentia.

Ad Jovis locum ab his observationibus obtinendum angulos supputavi
parallacticos


	dies. h.	dies h.	dies h.
sive circuli verticalis } Maii — cum Ecliptica —	26. 9. 00.	27. 9-07	28. 9-19
	⁰ 80=47 . .	⁰ 79=49 . .	⁰ 78. 36.
4 ^s à fixa distantia observata	. . . 10—04	. . . 6. 02	. . . 6—03
differentia obs. alt. —	. . . 6—30	Azym. 1—50	Azym. 3—30
Ergo angulus positionis —	31—01 .	62. 38 .	66. 03 .
Et planeta in antecedentia fixa	. . . 8. 38	. . . 2. 51	cons. 2. 27
cum minori latitud. Boreali —	. . . 5—11	. . . 5. 19	. . . 5. 32

Fixa latitudo Tychonica 1°—20'—30"—Bor. Locus mihi 9°—57' 30";
at Streetio 9°—54'. 09", cui propterea locus 4;

	Ab epilogo tabularū Ca- rolinarum	Error	Lat. ob- serv.	Lat. sup- putata	Error
Maii. h.	"	"	"	"	"
26. . 9. 00.	9—45—31	9—40—51	1. 15. 19	1. 16. 39	+ 1. 20
27. . 9. 07. in m	9—51—18	9—46—28	1. 15. 11	1. 16. 28	+ 1. 17
28. . 9. 19.	9—56—36	9—52—16	1. 14. 58	1. 16. 17	+ 1. 19

Quid amici de hoc phænomeno observârint, nondum audio, tamen si
quotidie audire expecto. De transitu, Junii 30. expectato, nihil obser-
vare potui ob nubes & pluvias, diebus illis precedentibus & sequentibus
frequentissimas.

3. Martis observatio ab eodem J. Flamstedio.

A Nno eodem 1672. Maii 14. st. v. mane, Ibat ♂^{tis} sidus prope stel-
lam, dictam, Quæ ad Clunes Aquarii; cujus latitudo 2°. 0'.
0". locus tum mihi 24°. 12'. 09" ; Streetio, 24°—09'. 06". è qua
notabam,

Altâ fixâ verè 9. 40. 2. 29 mane, Martis in eodem Azymutho }
precise distantiam ————— } 24—17 Vide
11—12. eandem denuo distantiam ————— } 24. 24 Fig. 2.
h.
12. 00. 2. 51. planeta discesserat ab eodem Azymutho }
eratque ad ortum à linea: Azym. differentiâ — } 0. 55

Horâ 2. 29 mane. Angulus parallaclîcus erat	82. 26
Ergo δ in consequentia fixæ	3 . 11
cum majori latitudine Australi	24 . 04
δ propterea latitudo	2 . 24 . 04
locus verus	Streetio \approx 24 . 12 . 17
	Mihi \approx 24 . 15 . 40
At locus Martis è tabulis Carolinis supputatus	\approx 24 . 17 . 22
Scil. jústo promotior $5'. 5''$. latitudo vera, $2^\circ. 27'. 29''$. major etiam ob-	
servatâ. $3'. 25''$.	

4. Apographum Epistolæ à Dn. Johanne Flamstedio, Astronomo Derbienti, ad Editorem scriptæ, de Transitu Planetæ Martis ad tres Fixas in \times , celebrando mens, Sept. & Octob. 1672.

— **M**itto Tibi Schema Transitus δ tis ad tres Fixas in \times , ut fidem ea de re pronuper datam liberem. Rem ut potui deproperavi, ut quibus visum Tibi fuerit prædictionem hanc impertiri, maturè se parent ad curatas ejusmodi habendas Observationes, quales Phasis hæc de-
pescit.

Locorum δ tis in Ephemeride subjectâ calculum inii ex Tabulis Streetii ad h. 8. o'. p. m. Derbiæ, & tempus æquale. Ea quæ ex Heckero transcripta sunt, ad eundem reduxi. Accuratum subduxi calculum loci Planetæ ex Tabb. Streetii, ut diurnus ipsius motus inveniat exactè, ad comparandum eum cum observatis motibus in dato spatio temporis, atque ad Parallaxes inveniendum; quanquam in ea sim sententia, quam bene fundatam putem, Heckeri Ephemerides vera loca δ tis longè propius ostendere, quàm Streetii numerum.


1672. Derbiæ δ^{is} locus in h.8.0'.0". p.m.	\times	Latitudo M. A.	Dist. δ^{is} à Terra qual. \odot 100000	Heckeri δ in \times	Ephem. Lat. M. A.	δ^{is} Parallaxes		
						Street.	Kepl.	Wing.
Sept. 15	13. 11. 13	4. 50. 11	41318	12. 54	4 46	0.36	2.25	5.41
st. ver. 16	13. 1. 26	4. 45. 26		12. 45	4 42			
17	12. 52. 25	4. 40. 43		12. 36	4 37			
18	12. 44. 10	4. 36. 0	42296	12. 28	4 33	0.35	2.22	5.30
19	12. 36. 41	4. 31. 10		12. 22	4 28			
20	12. 29. 58	4. 26. 21		12. 14	4 24			
21	12. 24. 0	4. 21. 34	43385	12. 8	4 19	0.34	2.18	5.25
22	12. 18. 48	4. 16. 43		12. 4	4 14			
23	12. 14. 24	4. 11. 52		12. 0	4 9			
24	12. 10. 46	4. 7. 0	44589	11. 56	4 4	0.33	2.14	5.16
25	12. 7. 56	4. 2. 9		11. 53	4 0			
26	12. 5. 3	3. 57. 18		11. 51	3 55			
27	12. 4. 38	3. 52. 27	45895	11. 50	3 50	0.32	2.11	5.7
28	12. 4. 12	3. 47. 38		11. 50	3 45			
29	12. 4. 34	3. 42. 50		11. 50	3 40			
30	12. 5. 43	3. 38. 3	47302	11. 51	3 36	0.32	2.7	4.58
Oct. 1	12. 7. 42	3. 33. 16		11. 53	3 31			
2	12. 10. 29	3. 28. 30		11. 56	3 26			
3	12. 14. 4	3. 23. 46	48804	12. 0	3 21	0.31	2.3	4.49

Solis parallaxis horizontalis est Streetio ————— 0. 15.
 ————— Keplero ————— 1. 0.
 ————— Wingio ————— 2. 21.

Unde, nec non ex distantis δ^{is} à Terra, inveni Parallaxes ejus prout in Tabula; quæ cum satis ampla sint & quantitate sensibili in instrumentis meis, non dubito, me, favente Deo, facile inventurum, admittat ne ipsas Cœlum. Minores eas exspecto Keplerianis; majores Streetianis. At verò compertum cum habeam, quantum conjecturæ meæ antehac aberraverint, volo planè ut ducant me Observationes meæ, torquere eas nolo.

Rogo Observatores, ut nudas mihi Observationes suas communicent, notatis earum ritè habitatum temporibus; quibus meas adjicere non deestabo, si iis instituendis Cœli annuerint. Vale.

Dab. Derbiæ d. 31.
 O Julii 1672.

Martis, prope Fixas in 
transeuntis, loci depicti,
ad hor. 8. p. m.
Derbiæ
1672.

Octob. 1. 

 3 Octobris


2. 

30. 

 30

29. 

28. 


27. 

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26. 

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25. 

 24 26


24. 

*

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23. 

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22. 

21. 


20. 

 18

19. 


A Tabulis Carolinis

Sept. 15. 

16. 

17. 






18. 

♂  15

Ab Ephemeride Heckeri.

*

28

	Streetio	Keplerio	Lat.
 26	11—40—22	11—44 	3—58 
* 27	12—8—22	12—12— 	4—10—30 <i>Aust.</i>
28	12—11—52	12—15—30	4—44— 
	*	*	

An accurate Description of the Lake of Geneva, not long since made by a person that had visited it divers times in the pleasantest season of the year; and communicated to the Publisher by one of his Parisian Correspondents: English'd as followeth:

YOU have reason, Sir, to demand of me an account of the *Lake of Geneva*, which, in my opinion, about this season of the year (in *June*) is one of the most pleasant places of the world. This is the third time I have visited it, and I am, if I may say so, more charmed with it than the first.

I shall say nothing of the *Alpes*, nor of mount *Jura*, which do environ it, which by this Lake as by a large Ditch are separated from one another: for that would not give you a sufficiently fair *idea* of the Country. Be pleased therefore to represent unto your self a *Croissant* of water, one extremity whereof is eighteen leagues distant from the other, and the banks of which are gently raised to some heights, then to collines, and at length to stupendious mountains; which yet are not so linked to one another but that they leave betwixt them interstices of fifteen or twenty leagues prospects, checkered by meadows, corn-fields, orchards, vines, Forests of Fir-trees, Snow lying on the sides of the Rocks. All these objects, which at a distance are confounded, and seem to make but one, have near hand their several beauties: So well is the Country intersected by *Rivolets*, which, after they have served to make Iron, Paper, &c; run into the Lake, carrying with them very many fountains.

But leaving these things, I shall now content my self to entertain your Curiosity by giving you a candid relation of what I have there observed in the space of four months.

Although I have told you, that this Lake hath the figure of a *Croissant*, yet that point, where is *Geneva*, is somewhat longer and more extended than the other. This *Croissant* where 'tis largest, which is from *Morges* to *Thonon*, is about five good leagues over. That which hinders from making an exact estimate of its largeness in other places, is, that the Winds by driving the water toward the banks have made certain points, which advance far into the Lake, in such sort that when one happens to be opposite to the other, the Lake seems to be narrow: As may be observed in going from *Geneva* to *Nion*, where it seems as if the *Pharus* or Watch tower of *Prangin*, which is in *Suisse*, did almost touch *Savoy*; whereas yet one is a league distant from the other. And, what is remarquable, is, that at the coming out of this Straight, the Lake hath there almost its greatest breadth and depth.

The water of this Lake is very good to drink, and ever so limpid, that even in the roling of the waves, which sometimes go high enough, the water is not troubled but along the banks. And if one do attentively look down from the Castle of *Chilon* or from any of the neighbouring heights into in the bottom of the Lake, he may see high mountains

E e e e

under

under the water. And the water is so deep before *Vevray*, that the sounding line at the end of four hundred fathoms seems, because it will not stay, to touch upon something slippery. 'Tis held to be 500 fathoms deep before *Roole*; and 'tis affirmed, that near this great depth there may be seen a kind of *Isle* under water.

The *Rhone* enters at one of the points of the *Croissant* into the Lake, and issueth out at the other; but with this difference, that whereas he comes in dirty and miry, he ever goes out so pure and clear, that under the bridge of *Geneva*, where the water is deep twenty five feet in summer, you may well discern the smallest stones at the bottom. And the same water, which in this place appears of a Saphyrin blew in the shade of the Houses, appears altogether green, nor is so transparent, when the Sun shines on it.

There is a great diversity of opinions as to the *Current* of the *Rhone* in the Lake; some maintaining, that it may be discerned, others denying it. Having heard the sentiments of the Curious of *Lausanne* and *Geneva*, and the opinions of the most knowing Fishermen that are there in great number, and especially at *Coupet*, I believe with the latter; That, although the *Rhone* entring into the Lake looseth its violence, yet doth he still keep some sensible motion in some places, and every where observable, and that no Trouts are taken any where in this Lake but in this *Current* of the *Rhone*; which is what these Fishermen call, to go and fish *sur le mont*.

Others there are, that go further and say, that one may every where distinguish the water of the Lake from that of the *Rhone*: But the Fishermen will not allow this, but assert, that there is no other mark than those lately alledged, *viz.* of the Trouts, and the *Current*; and that the latter of these is alone sufficient, in calm weather, to observe the *Current* of the *Rhone* from the place of his entring the Lake unto that of his going out.

The water of this Lake commonly begins to increase about the end of *January*, or the beginning of *February*, and continues to do so unto the twentieth of *July*, and often unto the very month of *August*; and then it insensibly decreaseth, so that the water is less high in winter than summer by 12 or 15 feet; the frosts draining the Springs, or rather freezing the waters that issue out of them.

About this Increase of the water there are also different opinions. 'Tis true, they all believe in general, that the principal cause of the increase of the water is the melting of the Snow, and of the mountainous Ice, that is in the winter formed of the waters of the Springs and Torrents, which the frost fixeth. This is so true, that when there is much snow in winter, the waters are very high the ensuing Summer. But when great Rains chance to fall in *January*, then the Snow, not yet being well hardned, melteth on a sudden altogether. And when this melting is not so violent, all the Snow, that will melt, melts at the end of

of *May* or at the beginning of *June*: so that, there remaining but the stock of Ice for entertaining the increase of the water unto the month of *August*, some have thence been induced to say, that this increase, which amounts, as hath been said, to 15. feet water generally all over the Lake, is caused by the herbs, growing, as they pretend, at its bottom in great abundance; and that these herbs, whilst growing, do force the water upwards, and dying in autumn make the water to sink lower. Which is not satisfactory to me, because there are no herbs seen upon the Lake, and very little within it, and the banks being very dry.

Others there are, that will have this water rarified by the heat of the Sun, and thereupon swelled on the borders, hot water not being so high in the middle as cold.

This is certain, that all the rivers and torrents, that fall into this Lake, carry with them store of stones and earth, which may indeed enlarge and raise it: But such an augmentation or rise cannot be sensible but from age to age; not to mention, that in winter, whilst the water is low, the stones of the Lake are carried away for building or fortifying at *Geneva*.

At the issuing out of the barres, that forme *Geneva*, on the side of the Lake, are seen in the water two or three huge Flints, standing out of the water; the chief of which they call *Niton*: And the tradition is, that it formerly was an Altar consecrated to *Neptune*; there being also a place cut out in the middle, which they take to have been the place for the sacrifice. On this Flint seven or eight persons can sit; and sometimes, when the waters are very low, there are found about it knives, and needles as thick as bodkins of tweezes, and much longer; both of brass, well enough made, and esteemed to have served for the sacrifices.

This Lake in serene and calm weather appears sometimes, and that even before Sun-rising, as if it were made of divers pieces, differently coloured; part of it being browner than the rest: which seems to be caused by a breath of wind passing thorow the water, coming either from the bottom of the Lake, or from above; though others think this gentle agitation to proceed from some springs that are at the bottom, making the water shiver above. But that part of the water, that is not moved, appears as even and smooth as a looking-glass, or like water traced by a ship. And as for the Colors, they are, in my opinion, an effect of the neighbouring mountains, the different images of which, being confounded in the water, make an appearance of very pale colours.

After that the Rhone is entred into the Lake, he retakes not his impetuous course before a quarter of a mile's distance from its coming forth again, that is, above *Geneva*. And the nearer he comes to that Town, the more his bed becoms narrow, and consequently his course more rapid. Yet this rapidness hath been in our times once surmounted by wind, and once by water. To understand which, you may ima-

gine, that in *Geneva* there is a streak of Land about an hundred fathoms long, which divides the Rhone into two parts, passing under four bridges, then cover'd with houses. From the point of this Isle unto several ranks of stakes on that side of the Town there are about a thousand common paces. This whole space of water, which makes the figure of an V (whereof the Isle is the point, and the Town formes the sides; and the stakes, the empty place of the end,) hath been once laid dry by a violent wind, after this manner. One day in the winter of the Year 1645, there arose in the morning about 9 a clock so furious a wind, that not only it uncovered the houses, but also laid dry the bed of the Rhone above the bridges, so that many, in the view of all the town, crossed quite over it dry-foot, and one of the sons of M. D'Aubigny took up some medals, which he found in his way. This passage was free during an hours time; at the end of which the Rivers retook its course. At that season the water being very low, and a west-wind, to arrive at *Geneve*, being pressed by the high mountains, that bring it upon the town as by the nose of a pair of bellows; it came to pass, that that wind did violently bear upon the water near the said bars, keeping suspended the water that was beyond, and those waters, that were beneath, running away downwards by a declivity, and under the shelter of the houses. Whilst I was scrupling at this relation, they brought me *Gallasius* his Commentary upon *Exodus*, printed 1560; where 'tis recorded, that the like accident had fallen out at *Geneva* at the time when that Minister lived there, a South-west-wind having made the Rhone to recoil into the Lake, and many people having thereupon passed over dry for an hours time.

Concerning the other accident; you may remember, that the river *Arve*, which is a kind of Torrent, falls into the Rhone, about a 1000 paces beneath *Geneva*. In the month of *December* in the Year 2652. the said *Arve* did so extraordinarily swell, that not only it over-run its banks with impetuosity, but also interrupted the course of the Rhone, and forced it to re-enter into the Lake for the space of fourteen hours; though some do esteem, that the *Arve* dis-gorged it self for that time into the Lake, by passing over the water of the Rhone, which, in their opinion, continued his course under the water of the *Arve*. However, the water was seen at *Geneva* to re-enter into the Lake.

But to conclude, this Lake doth very much abound in Fish; but that which is observable is, that those Fishes have as'twere cantonized themselves, and divided the Lake amongst them. The *Trouts* are not to be found there, but as hath been already mentioned, in the Current of the Rhone: the *Carp*s have taken up their quarter towards *Vevray*: the *Pikes* and *Pearches* have also their habitations apart. But some other fish, that are but passengers, not living constantly in the Lake, spread themselves almost every where indifferently.

The great Trouts pass out of the Lake for four months of the Summer, and are taken in autumn when they are returning thither. The Fishing is farmed out at *Geneva*; and there are Conservatories where many of those big Trouts are kept, among which there are some that weigh fifty pounds. Sometimes they catch Pikes there of eighty pounds weight; and a pound weight at *Geneva* you know to be eighteen ounces.

In the months of *July* and *August* they fish there for the Fry of *Pearches*, at a time when they are no bigger than the smallest taggs. These are a very delicious dish, there called *Mille Cantons*.

I shall add no more than put you in mind of that Duke of *Savoy*, who renounced his Crown and the Pontificat it self to pass deliciously the rest of his dayes at *Ripailles*, where he made so good cheer to all that visited him, that, to express a very merry entertainment, they say still, *faire Ripailles*.

An Account of some Books.

I. *LUX Mathematica, Collisionibus Johannis Wallisii S. Th. D. & Thomæ Hobbesii Malmesburiensis, excussa: Multis & fulgentissimis auctaradiis, Auth. R. R. Adjunctâ Censura Doctrinæ Wallisianæ de Libra, unâ cum Roseto Hobbesii. Londini, pro Guil. Crook in vico vocato without Temple-bar, 1672. in 4°.*

THE Author of this Book dedicated to the *Royal Society*, having told the Reader in the *Preface*, that he hath deduced the rise and occasion of the Disputes betwixt Dr. *Wallis* and Mr. *Hobbes*, and commended the many and difficult Propositions and Demonstrations, said to be advanced by the latter of them, and compared therewith those of Dr. *Wallis*; having also subjoined in the same the things that by Mr. *Hobbes* are judged manifest: Proceeds in the Body of the book to the Controversies themselves; endeavouring to vindicate Mr. *Hobbes's* Assertions from the Objections of Dr. *Wallis*, particularly those, that were published in N°. 73. and 75. of these *Transactions*; which Monthly Papers, (to touch that by the by,) this Author, by a great mistake, calls p. 36. the *Transactions of the R. Society*; whereas they are notoriously composed by a Single Person, who hath not only declared so much in several places of these *Tracts*, and most solemnly in N°. 12. p. 213, 214; but also adds his very name to them in the Dedications of every years volume.

The Controversies, by the Author enumerated, are 13.

1. *De Rationum calculo per magnitudines Infinitas*
2. *De significatu vocis Rationis apud Mathematicos.*
3. *De Ratione rectanguli ad Parabolam, ad Paraboloideas solidum, ad Parabolam Cubicalem, & ad alias Figuras ipsi inscriptas.*
4. *Utrum Numeri quadrati radix eadem sit cum Figuræ quadratæ latere.*
5. *De Puncto, de Longitudine sine Latitudine; & an Angulus semi-circuli sit rectus?*

6. *D:*

6. *De Sectione lineæ rectæ extremâ & mediâ ratione.*
7. *De Polygonis regularibus.*
8. *De Equatione lineæ Rectæ & Arcûs circuli.*
9. *De Tangente arcûs graduum $22\frac{1}{2}$.*
10. *De Prudentia ad studium Geometriæ necessaria.*
11. *De latere Icosædri.*
12. *De Quadratura Circuli.*
13. *De natura Libræ.*

A Reply to these Animadversions, being expected from the Person concerned, will probably be inserted in the next following Number.

II. *OPTIQUE de PORTRAITURE & PEINTURE, contenant la Perspective Speculative & Pratique accomplie, &c. Par Gregoire Huret, Desseignateur & Graveur Ordinaire de la Maison du Roy, & de l'Académie Royale de Peinture & Sculpture. A Paris, 1670. in Fol.*

THis Elegant volume in *French* declareth the chief aim of its Author in the composition thereof to have been, to contribute what he could to the instruction and improvement of youth, studious of these excellent Arts, and groundedly to teach them the Rules and other means, that are really useful and absolutely necessary to them in the same, so that they may both make use of them, and discern them from abundance of false and imperfect ones, that, he esteems, have been delivered to them in most of the Treatises hitherto made about this subject.

In the performance of which, he divides this Volume into two parts: The *First* contains the accomplish'd (for so he calls it) *Practical* Perspective, to represent the sumptuous Architectures of the most magnificent Buildings in Perspective, by two ways; the *former* shewing the means to arrive to a compleat exactness, but such as are only taught to inform the understanding, and not to be practised, if you will not: the *latter* containing the shortest and easiest means of all that have been publish'd hitherto; and that for general practise, and all without using any point of distance nor Geometric plane.

The *Second* part discourses of *Speculative* Perspective; viz. of the Demonstrations and Explications of the Fundamental Secrets of the Rules or Means contained in the *First* part; together with the most Curious and most Considerable Questions, that have been hitherto proposed upon this argument of Pourtraiture and Picture, with their Solutions.

About the end of this Book the Author annexes an Accompt and some Remarques of his, concerning the Design of M. Desargues's Rough-draught of his Treatise of Coniques, entituled *Leçons de Tenebres*.

We must not omit to take notice here, that in the Extract of the Privilege given to this Book (pag. 159.) mention is made of two other Books

Books composed by this same Author ; entituled, 1. *La Gnomonique Speculative & pratique, contenant les regles pour faire les Quadrans Solaires Astronomiques, Babylonique, Italique, & Ancienne Judaïque, & tous les cas qui leur sont appliquez.* 2. *La Section des Solides, Speculative & Pratique, appliquée à l' Art de l' Architecture, pour les constructions precises des Traits de la Coupe des Pierres, ou Vousssoires de toutes sortes de Voutes, avec la declaration entiere des Secrets fondamentaux des-dits Traits.*

III. Christiani Friderici Garmanni, *Physici Chemnicensis, Academici Curiosi, HOMO EX OVO.* Chemnitii, 1672. in 4^o.

THis Author having collected what of late years hath been by divers curious Anatomists asserted and published concerning the Generation of other Animals, as well as of Fowl and Fish, out of Eggs ; and taken with *Kerkringius* particular notice, *tam Virgines quam Conjugatas sapissimè Ova excernere* (which he no more wonders at, than that Hens and other Birds are *matres & tamen virgines* ;) having, I say, done that, he proceeds to consider the advantage of this Doctrine, and its happiness in explicating many *phenomena*, hardly explicable without it ; such as are, the Production of more *fœtuss* than one ; the production of Monsters ; the many odd Symptoms in Women, from the putrefaction or imperfect constitution of the Egg or Eggs ; the Production of Mola's ; Barrenness, &c.

Having dispatched this, he takes occasion to examine this Question, *An fieri Conceptio possit extra Uterum ? Ubi nonnulla differuntur de Homunculo Chymico sive Paracelsico ; quæ apud ipsum vide Authorem.*

IV. *A short and sure Guide in the Practice of Raising and Ordering of FRUIT-TREES ;* by Francis Drope B. D. late Fellow of Magdalen Colledge in Oxford. Printed at Oxford, 1672.

THis piece appearing by the Preface to have been writ from the Authors own Experience, we thought good here to take notice of it, and to recommend it to the perusal and examination of Ingenious and Industrious Planters, that they may compare with the already publish't writings of others upon this subject, and their own practice, the particulars insisted on in this Discourse ; which are principally ;

1. Of raising Stocks from the Seed ; from which the best of Stocks, in the Authors opinion, are produced ; together with particular directions to the best kind of ground to sow the respective seeds or stones in ; and what grafts take on what stocks.

2. Of the Nursery or place where young Trees are to be brought up before the Transplantation into an Orchard. Here are cleared the difficulties about the choice of ground for the Nursery, and about the due ordering thereof before Planting. Then, the Work it self and the season thereof considered. Further, the earlier and late removal examined. Lastly, several circumstances, to be observed in the Planting, recommended.

3. Of

3. Of Grafting, and the several wayes thereof; together with the due Preparation and Time for it. Here the Author treats of Stock-or Cleft-grafting; of Whip-grafting, (otherwise called Packing or Splicing;) of Shot-grafting, like the shooting of two pieces of timber, as in a Ship-mast, together; of a Peculiar way of grafting, much used by some of the best Nursery-men about *London*, here commended for its certainty and easie dispatch; of a singular way, tryed by the Author, and by him esteemed the nearest and least dangerous and hurtful for the grafting of great Stocks. In this same *Chapter* is discoursed of *Inarchings*, to be used in Trees, whose Cions will not be grafted if taken clean from the Tree, whereon they grew at the first: Where the Reader is taught, how in a year or two store of Aprecocks may be produced without Inoculation, by setting before-hand Plum-stocks round about an Aprecock-Tree at such a distance, as that they may be grafted by these wayes of Inarching.

4. Certain Rules to be observed *in and after* Grafting; together with a censure of vulgar Grafter, that always pick off the side buds, till such time as the Tree is high enough: Adding also some advertisements for the Choice of Grafts.

5. Of Inoculation, and the principal time for it; together with directions, what sort of Trees are first to be inoculated, which last, and which between both: As also, of the quickest and safest way of Inoculation; and of the Authors opinion concerning that manner of Inoculation, which is made without taking away the wood from within the Escutcheons. To which are added instructions concerning the fittest Weather for inoculating; and how to prevent mischief by much heat, drought, and hard winter; as likewise a mark whereby to know, whether the bud have taken or no. All which is concluded with an assignment of the Cause, why the greatest part of Trees yield better and fairer fruit through Insition, than when permitted to bear from Seed? The determination of which is here attempted to be made by comparing Trees and Animals, and by the consideration of the manner of Nutrition in the latter.

6. Of Stocks raised without Seed, and Trees without Insition: concerning which the Author delivers some things concerning Stocks procured out of the Woods, and Suckers from the Roots of Trees, where Seedlings cannot be obtained. To which are added the ways of propagating Trees by *Layers*; as also by Roots left in the ground.

Advertisement.

IT was thought fit, herewith to give the Reader notice, that the next of these Tracts will not come abroad till the end of *October* next.

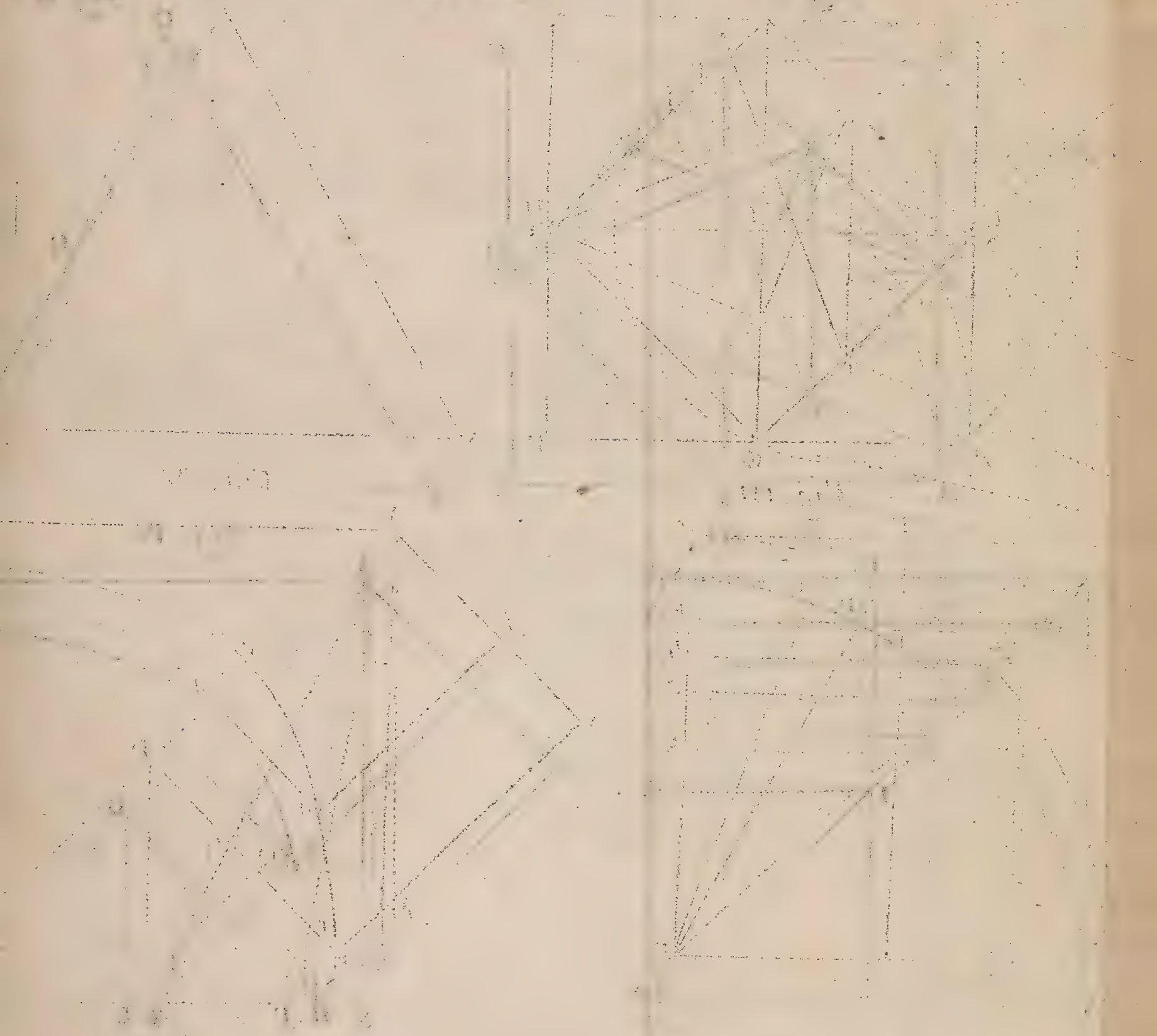
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Trans. N. 87. Fig. I. Tab. II.

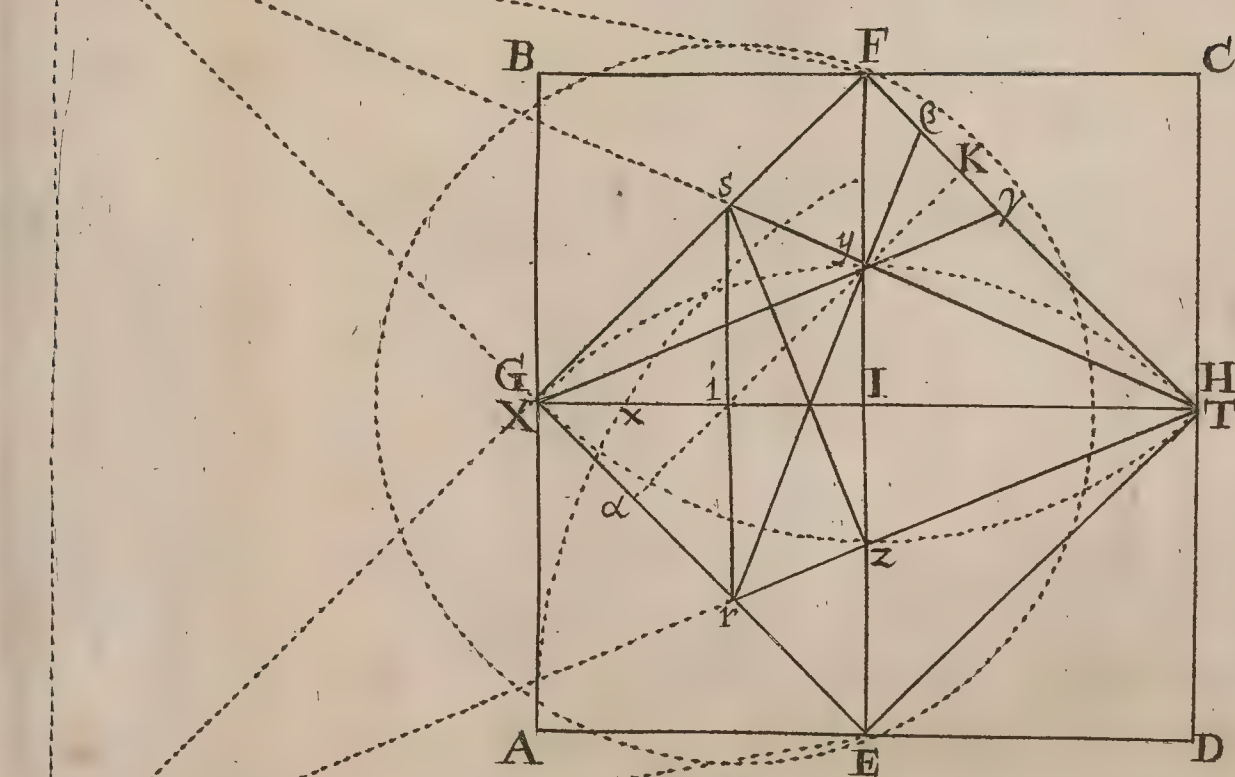


Fig. II.

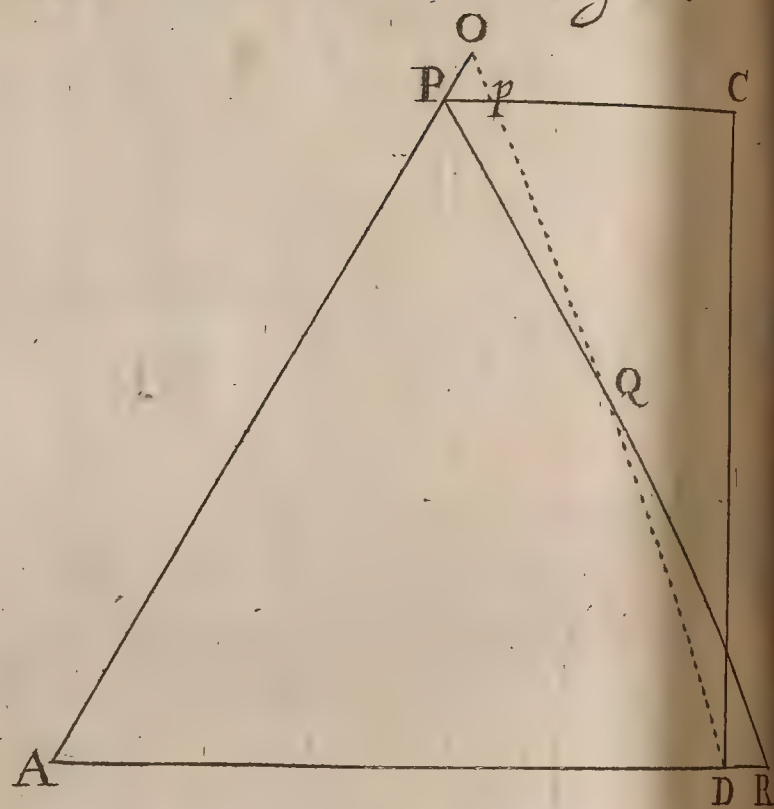


Fig. III.

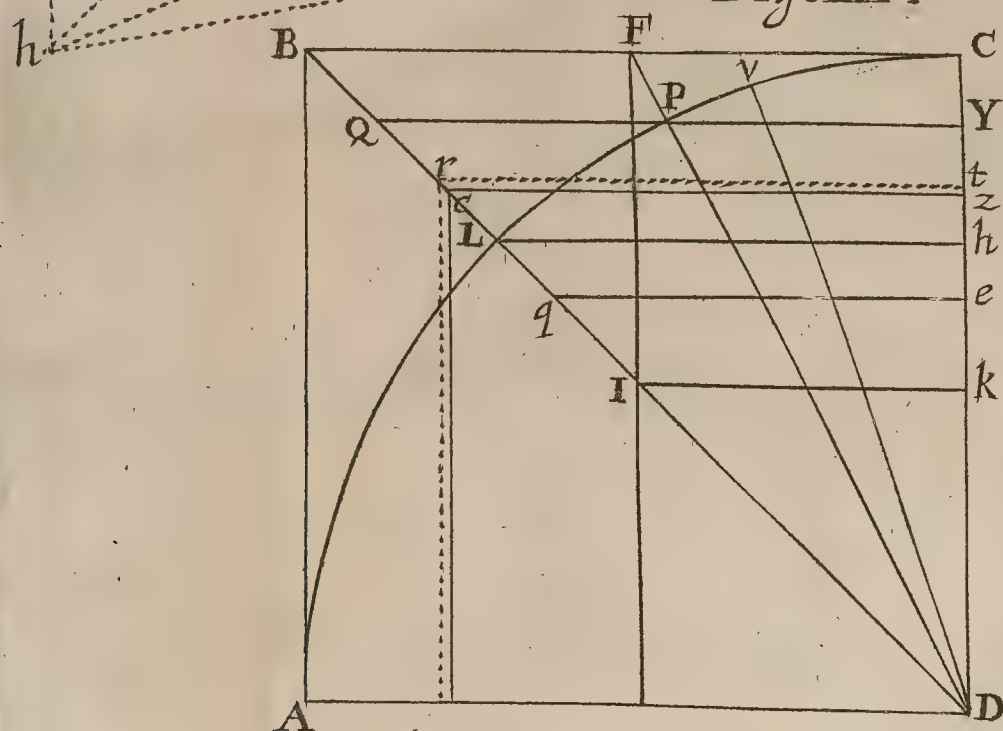
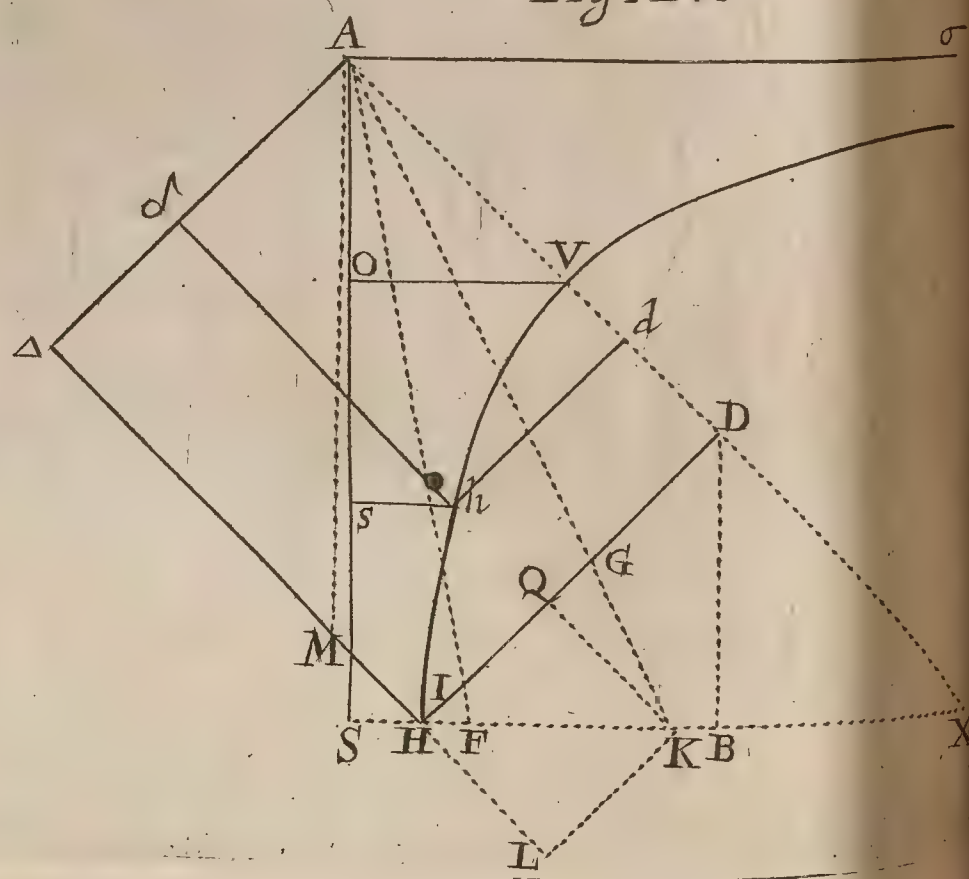


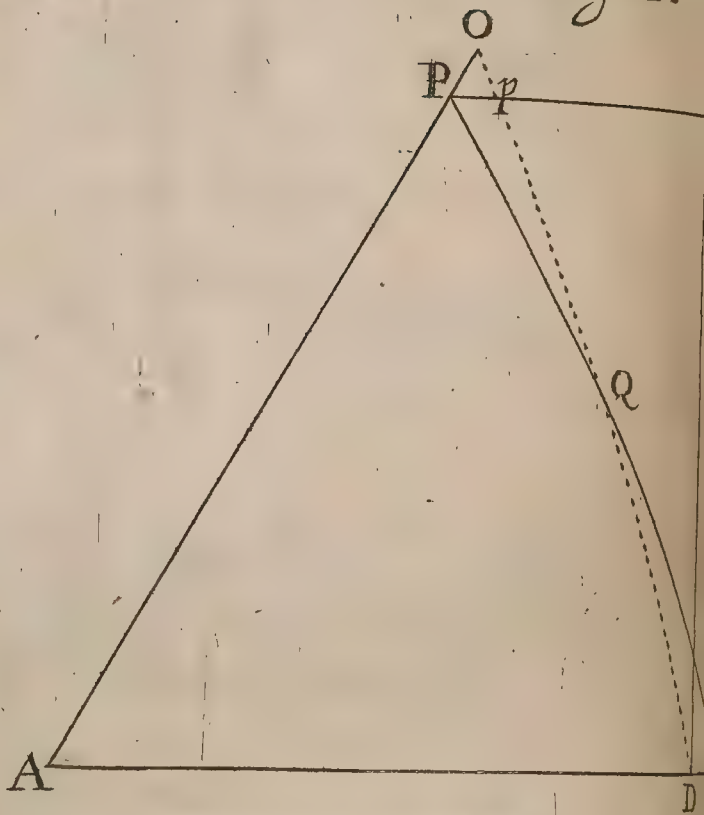
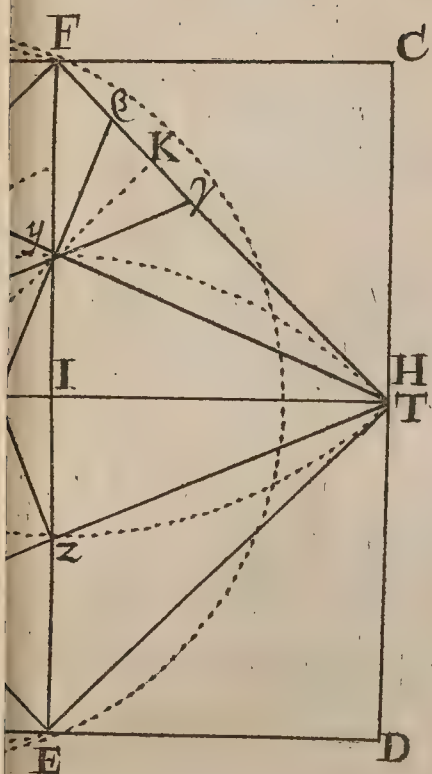
Fig. IV.





Tab. II.

Fig. II.



III.

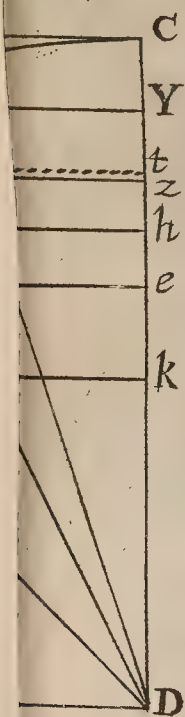


Fig. IV.

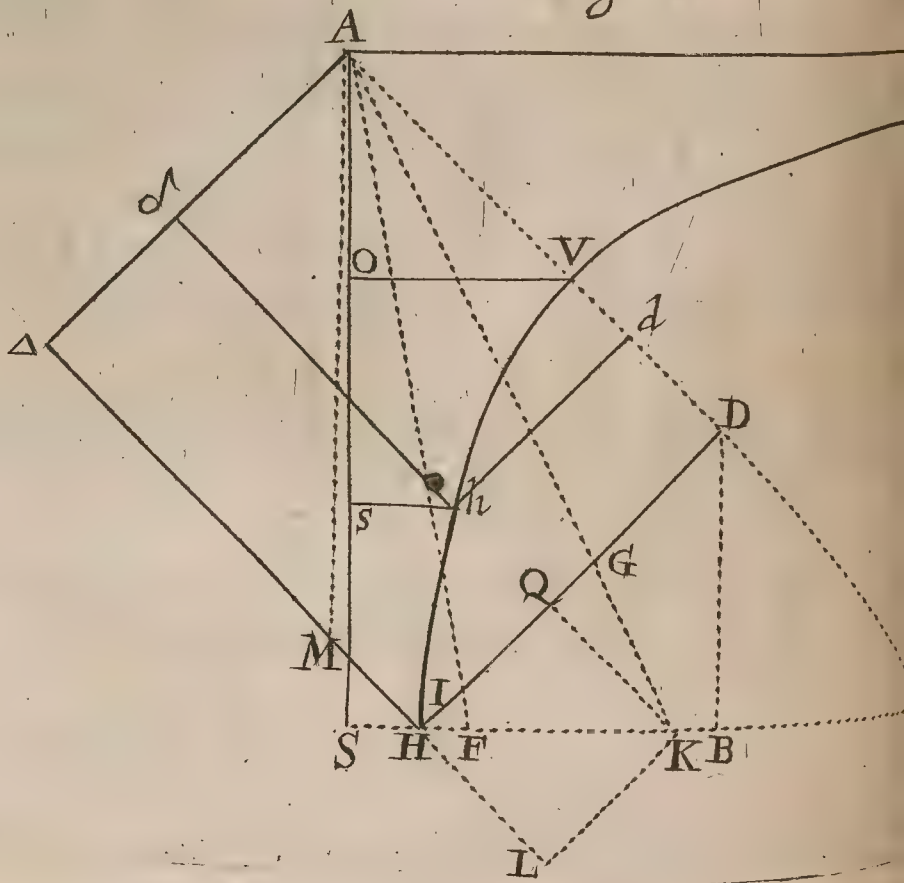


Fig. II.

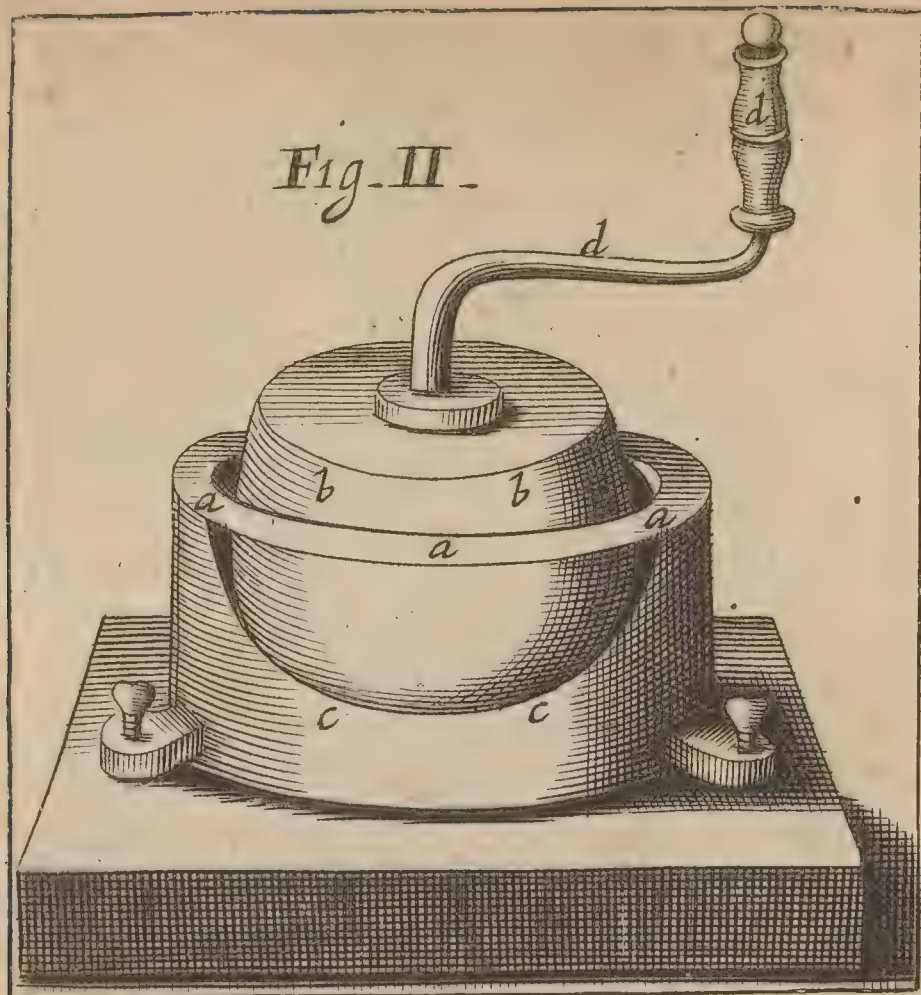
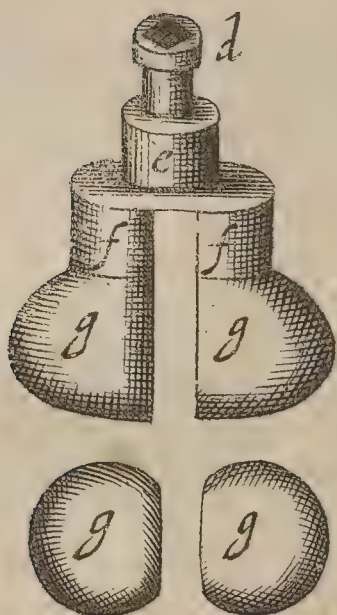
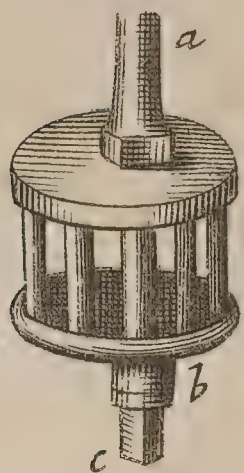
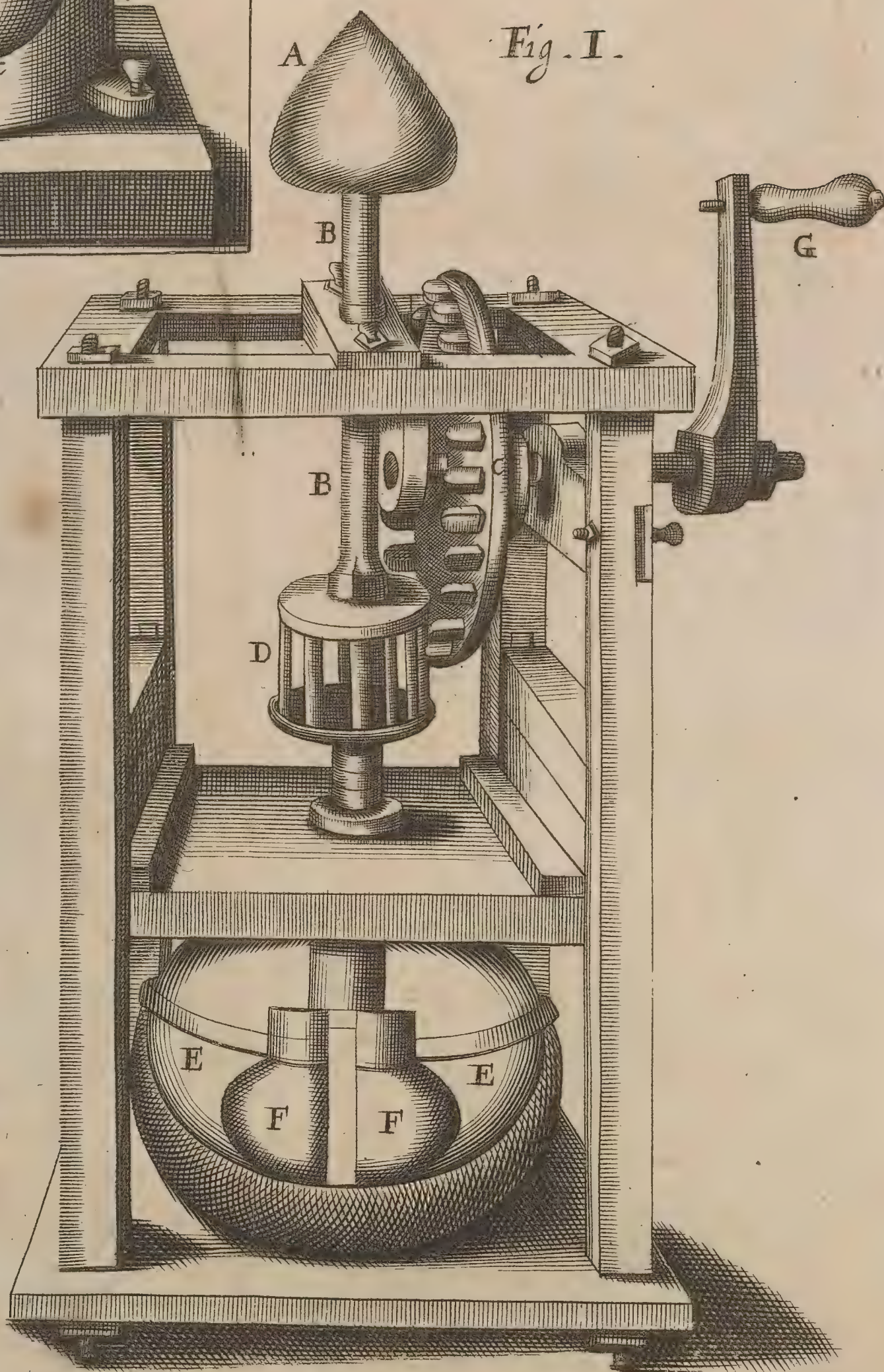


Fig. I.







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CO

PHILOSOPHICAL TRANSACTIONS.

For the moneths of September and October.
Octob. 14. 1672.

The CONTENTS.

An Extract of an Epistle of Dr Langelot, representing, Of what great use Digestion, Fermentation, Triture or Grinding, if they were well regarded, might be in Chymistry; and proving it by very considerable Experiments, said to have been made by himself.
An Extract of a Letter of Mr. Listers, enlarging his former Notes about Kermes; and withal insinuating his conjecture of Coccineil's being a sort of Kermes. *A Letter written from Florence by Mr. Tho. Platt, containing divers remarkable Experiments, there made upon Vipers, since M. Charas's second Reply to Sig. Franc. Redi.* *Doctor Wallis's Answer to the Book, entituled Lux Mathematica, &c.* *The same Doctors Additions to what he lately publish'd in his Works De Motu & Mechanice, concerning the Center of Gravity of an Hyperbola.* *An Accompt of some books: I. Tractatus de VITA NATURÆ: &c. Auth. Franc. Glissonio, Med. D. & P. &c. II. Jeremiæ Horroccii Opera Posthuma, unâ cum Crabtræi Observat. Cælestibus, nec non Joh. Flamstedii de Temporis Equatione Diatriba, &c. III. Marc. Malpighii Dissertatio Epistolica de FORMATIONE PULLI in OVO. IV. De MENTE HUMANA Libri quatuor; Auth. J. B. du HAMEL. V. A Letter of Francesco Redi concerning some Objections made upon his Observations about Vipers; together with a Reply to that Letter by Moyse Charas: now both Printed in English. VI. De Gemmarum Origine & Viribus Exercitatio; A. Rob. Boyle: Now Printed in Latin.*

F f f f f

An

An Extract of a Latin Epistle of Dr. Joel Langelot, Chief Physician to the Duke of Holstein now Regent: Wherein is represented, that by these three Chymical Operations, Digestion, Fermentation, and Triture, or Grinding, (hitherto, in the Authors opinion, not sufficiently regarded) many things of admirable use may be performed. English'd by the Publisher.

After that this Learn'd and Experienced Physician and Chymist had often with himself consider'd, what the Reason might be, Why the chief Chymical Operations had been hitherto contemned, and by some reputed even for Chimæra's; he affirms to have found at last, that the true cause thereof is, that the Artists have not made use, as they should, of those means and ways, that would have made them successful.

Now of those means he assureth by his own certain experience these three to be the most eminent and the most admirable for use, viz. *Digestion, Fermentation, and Triture*; operations sufficiently discoursed of, but, in his opinion, little understood as to their efficacy and usefulness, which he here undertaketh to make out by some considerable and un-common experiments; thereby to encourage those that are studious of Chymistry, and to keep them from desisting when they should most pursue their work, as also from despairing of the success of this or that Operation though in appearance dubious.

First then he shews the excellent usefulness of *Digestion* * in

* Compare herewith, what our Noble Philosopher, *Robert Boyle*, many years since hath publish'd of the great Use of Digestions, namely in his *History of Fluidity and Firmness*, the first part, Section 12th. printed in London 1661. among other *Physiological Essays*, where he saith: *This Intimation I shall add for the sake of Philosophers, that barely by long Digestions (and much more if they be helped by seasonably repeated Distillations,) in exactly stop'd Vessels, and a due degree of heat, there may be made in the parts of many bodies, both Vegetable and Animal, so great a change from the state of consistence to that of Fluidity, as those that contenting themselves with ordinary courses of Chymistry, have not had a peculiar curiosity for tryals of this nature, will not be forward to expect.* This was also printed in Latin the same year.

the Preparation of the *Volatil Salt of Tartar*. Where having mention'd the difficulties and unsuccessfulness in other Processes, tryed by him, he assures us, That as soon as he made use of a long *Digestion* he succeeded so well, that the very first time he obtained, what he feared he should not have gotten by many *Cobinations*; which was, a pure white *Volatil Salt of Tartar*, leaving behind a few, quite insipid, feces of an earthen colour.

To

To this he adds another great use of *Digestions*, in duly preparing the *Essences of Mineral Sulphurs*; instancing by an experiment made upon *Corals*, as most clearly of all representing that great power of Digestions. He poured then some years ago upon fragments of *Red Coral* an Oyl, which among all distilled Vegetables is, as far as he knows, the mildest; desirous to try, whether he could extract a Tincture therewith. But finding after a long time no change at all in the Coral nor Oyle, he laid by all thoughts of it. But having one Winter other things to digest in a digesting Furnace, he thought good to resume that Corallin Operation, and to give the Bolt-head, wherein that matter was yet contain'd, a place there, not without good success. For within a moneths time, when he stirr'd it as he used to do, he perceived, that the bitts of Coral had a higher colour, and were grown softer, yet without any change in the Oyle. He therefore continued the same degree of heat, and after some days saw, to his wonder, That the Corals were altogether dissolved into a *very red Mucilage*, yet the Oyl still swimming upon them in their pristin form, without having received any tincture at all. He did shake the vessel vehemently and often, to see whether he could unite the Oyl with the Mucilage of the Corals; but all was in vain, the Oyl still ascending when the vessel was at rest, and the Mucilage subsiding. Whereupon he tried, whether he could combine them by digestion; but that also not succeeding, he powred off the Oyl (which he found to retain almost its former scent and taste) and powred upon the remaining Mucilage some Tartarised Spirit of Wine, of which by a short digestion it was resolved into a highly red Tincture.

By these two Experiments the Author thinks, he hath made it evident, of what value the hitherto neglected works of Digestion are; as also given a hint of the great efficacy there is in Volatil Salts, if they be fetter'd, and kept from avolation;

Secondly, to shew the power and use of *Fermentation* in Chymistry, he instances first in a *true Volatilization of Salt of Tartar* by means of the same, passing by what he saith he hath perform'd thereby upon *Antimony, Pearls, Coral, &c.* to be communicated hereafter, in his intended full Description of the Operations made in the famous Laboratory of *Gottorp*. He saith then, that to obtain the Spirit of the Volatil Salt of Tartar, he proceeded

ceeded thus ; He took of crude Tartar, 2, 3 or more pounds (according to pleasure) and first calcined it slightly and only to some blackness, to have, what is most necessary, a ferment to ferment the Tartar with. Having put this into a large pot, he poured on it so much water, that it stood an inch high above it : Then he gave it at first a gentle fire to make it lukewarm ; which done, he poured into it half a handful of finely pulverised Tartar, and shortly after saw some bubbles arise, that increased more and more. Which perceiving he continued as he had begun, at several times to pour in more powder of Tartar, whereby the fermentation was raised and quickned, the bubbles thereupon rising in so regular an order, as if they had been natural grapes; the colour excepted. But here he was to keep a very exact regiment of the Fire, such as all Fermentation requireth ; and took care also, least by a too copious affusion of the said powder the Ebullition should grow too vehement, and the pot run over. The fermentation ceasing, he put all that was in the pot into an Iron Bolt-head (a Glass one being in danger to be broken,) to which he often apply'd a wet linnen cloath, thereby to hinder a too great boiling up of the fermented Tartar, which else will suddenly run up, and pass into the Recipient it self. Wherefore the fire is also very carefully to be govern'd, and increas'd by little and little ; though at last it must be strong, to force up all the Salt. Which being observ'd by him, he found the gross and feculent Tartar by the said Fermentation so volatilized, that there remain'd not any fixt salt in the *Caput mortuum*. Which he saith he hath experienced more than once. He adds, that the liquor obtained from thence, having much water in it, added for the sake of the fermentation, is also to be much rectified, and that so far, till it appear whitish ; which shews that it holds a due quantity of Volatil Salt. Which Salt, of what value it is, this Author would have us estimate from the testimony of *Van Helmont*, c. 15. de Feb. p. m. 780. and from the wonderful virtue, himself saith to have found in it, both in internal and external affections of the body, and even in Gangreens themselves ; besides that by means thereof he hath prepar'd some essences, which in vain he had tried to make by other *Menstruums*.

Another instance he gives us of the great use of *Fermentation* in separating impure and noxious Sulphurs: which he prescribeth to try

try in *Opium*, whereby, according to him, it becomes not only a very safe medicine, but also a highly useful one for very many cases, if rightly used.

Take then, *saieth he*, of true Theban *Opium*, sliced, one pound; and pour upon it in a low Cucurbit ten pounds of fresh Juyce of Quinces very ripe, adding to it one ounce of pure and very dry Salt of Tartar; expose it to a gentle heat for a day or two, untill there appear some bubbles, which is a sign of the fermentation at hand. Then, to further the same, add four ounces of sugar very finely pulverised, and observe still such a degree of heat, as Fermentation requireth; which by so doing will duly proceed, and you shall see the *Opium* manifestly rise and dissolve *per minima*; taking heed mean while of the strong-scented stupifying Sulphur, which then is wont to steam out. You'll then also see a part of the impure volatil scum to emerge at the top, & the more terrestrial to subside at the bottom of the vessel; the purer part staying in the middle, which is a red liquor, like a Ruby, transparent; which you are with care to separate, filtrate, and by a due distillation to thicken to the consistence of hony. And this you must again dissolve by an highly rectified Spirit of Wine, filtering it, and digesting it for a moneth, that whatsoever of crude there may yet be in it, may be by that celestial fire ripened and brought to perfection. This Spirit being abstracted to a due consistency, you will find this Essence to be of that virtue, that the fourth part of a grain, or at most half a grain, taken in a proper vehicle, moist or dry, will perform very wonderful things.

Having dispatch't Digestion and Fermentation, he comes to *Trituration*, his last; by which alone he esteems many great and admirable things may be performed in Chymistry. To which he is perswaded he shall very easily obtain the assent of all those, that shall but observe and well consider the two following Operations, both experimented in the Laboratory of *Gottorp*, in the presence of the late Duke *Frederick*, a Prince exceedingly well versed in all kind of knowledge, especially in that of Chymistry.

The first Operation was made upon *Gold*; which, though the most fixed of all bodies we know, was, though it will not yield to Fire nor to any other known dissolvent, master'd by *Grinding*; which he assureth himself to have been an eye-witness.

ness of. But this it did by means of a singular Instrument, by him call'd a *Philosophical Mill*, whose structure is thus described.

- | | | |
|---------|---|--|
| Tab. I. | A. A Leaden Head pretty thick. | same, which is square. |
| Fig. I. | B. The Axis. | c. d. Here both the Pestles are affixed to the Axis. |
| | C. An indented Drum. | e. Here the Pestles are strengthened by a strong Brass-ring. |
| | D. A Drum consisting of Coggs. | f. Here both Pestles are strengthened by two Brass-cases. |
| | E. A Mortar. | g. Both the thick pestles of glass. |
| | F. Pestles. | |
| | G. A Handle, by which the Mill is turn'd. | |
| | a. The Superior part of the Axis, which is round. | |
| | b. The Inferior part of the | |

Follows the Operation it self.

Put Leaf Gold, as much as you please, cut very small, into a very thick Glass mortar, or into one of Gold, (such an one as the late King of *Denmark*, a little before his death, caused to be made for this operation :) In this Mortar, covered only with paper, lest any dust or other thing should fall in, grind the said gold night and day by an uninterrupted agitation of the Mill, till you see it reduced into a dusky colour. For which grinding there are commonly to be allow'd 14 days and nights. But if you will only work by day, there will need a whole moneth. This done, put the powder into a Retort, not very deep, but shallow, such as the English ones use to be; and drive it by a fire of sand by degrees, but at last by a very strong one; & there will come over a few but very red drops, which being digested either *per se*, or with Tartarised Spirit of Wine, give you a true *Aurum potable*, which is sincere, and un-imbued with any forrain quality.

The Remainder though they could also have easily resolv'd by Grinding; yet they thought good to make an Extract of it by means of their *Philosophical Acetum*, made of *Verdigrease*, Sulphur, and a highly rectified Spirit of Wine, by a long digestion: Whereby they got again a Tincture sufficiently red and of very great virtue. And that little that remained, which was but very little, they reduced into a body by the means of Borax; but it wanted its due weight.

'Tis true, *saith our Author*, that at the first view this operation seems to be gross, requiring much time and labour, but little Art; but well considered 'tis highly admirable, being assisted by the wonderful Salt of the Air, as the only Catholic dissolvent. And that that Salt is by the continual Grinding attracted and intermixt, many other Experiments, made by him about it, have taught him, which he reserves for the publication, hereafter to be made of the things done in the Gottorpi-an Laboratory.

The *second* Experiment of the use of this Grinding, was in a true and genuine preparation of the Mercury of Antimony: A process affirm'd not only made by himself before his Prince, but also by the hands of that very experienced Chymist of the Elector of Saxony, *Johannes Kanchelius*: to have more than one string to his bow.

The Operation consists in this; Grind first the *Regulus of Antimony* into an impalpable powder; and to one pound of it, add two pounds of very pure and dry salt of Tartar, and eight ounces of Sal Armoniac; and mix it well together. Then moisten it with some Urine of an healthy man, especially of one that drinks wine, if such may be had; and take care, to have this mixture ground for a whole day together without any intermission by two very strong young men; always, if there want moisture, sprinkling Urine upon it. Then put this mixture into a Bolt head and powre so much Urine upon it, that it may stand three inches high over it, and closing it well, keep it in digestion for a whole moneth, daily shaking it. And if during that time the mass appear to be dry, powre on more Urine. The Digestion being ended, form the matter into globuls with equal parts of beaten glass and calx vive, and dry it in the shade. Of these, extract the Mercury in manner following;

Let there be ready an oblong iron vessel, like a Bolt-head, into which powre cold water, and dig it into the ground: Upon it put an Iron plate with many holes in it, and lay thereon the said globuls well dry'd; Then fit also an Iron head, somewhat flatted, to it, that you may conveniently lay coals thereon, and thus keep a moderate fire for four hours: then increase the fire for as many hours, unto the last. After that, let it cool, and beware, not to stir the vessel digg'd in the ground, nor to pour out the water, before that be altogether cooled;

or else you will loose a great deal of the Mercury; as happen'd, it seems, to our Author, when his Prince, being impatient of delay, commanded the water to be poured out before 'twas time: For the Mercury, being by so strong a fire resolv'd into Atoms, is to be coagulated again by Cold.

This Mercury of Antimony our Author glorieth in, as having prepar'd and handled it with his own hands, and seen it with his own eyes, after the finisht distillation, running in the bottom of the vessel. Neither doth he care, if any do still call it a Non-Entity; or if any unwary Laborants be unsuccessful in the operation. It is sufficient to him, that he hath nothing alledged, but what he hath tryed himself, and candidly described. He wisheth such Operators to consider, how many things there are to be observ'd before and in the operation, and even after it, if you will be certain thereof. Which he saith may plainly appear even by the Operation of the Tartar alone; forasmuch as all Tartar is not equally good, and himself hath met with great diversity of the same: Besides which great care is to be had of the Fermentation it self of the Tartar; for if it be not duly made, the Tartar will not be resolv'd *per minima*; nor will the Grapes be represented in that natural shape they ought to be; nor will all the Salt, (which is the main thing) be volatilized. Further, if perhaps the fire be excessive during the Distillation, much of the Volatil Salt will be burnt up, and it will yield a strong smelling Spirit.

Having dispatch't this, the Author subjoyns an accompt, he met with among his Papers, of another way of Operation of *Grinding of Gold*; which though he have not yet tryed, yet it seeming to him very likely to succeed, he scruples not to communicate also. The instrument, to be used therein, he describes thus.

Tab. I.
Fig. II.

- a. *A Mortar of very fine Steel.*
- b. *A body serving for a Pestle, of the same Metal, which is to fit the Mortar, as 'tis delineated in the Figure.*
- c. *Is a small space, where is interposed a golden Plate, half a Ducat thick.*
- d. *The handle, by which the Pestle is to be managed in the work of Grinding, which is to be continued for three weeks; at the end of which the Gold will be resolved into a potable liquor.*

This

This way, as it is much simpler, so 'tis by the Author esteem'd much more expedient than the former, by reason of the Sulphury-saline quality of Iron, which by Grinding being open'd and highly subtilized, acts the more powerfully upon the most solid body of Gold, and attracts withall the Salt that is in the Air in greater plenty, than can be done in a Glass or Golden Mortar. And if it be objected, that by that long continued Grinding the steely particles are worn off and commixt with those of the Gold; The Author would have it consider'd; how great a Cognation there is between those Sulphurs, and also, how great is the Use of Digestion, separating the pure from the impure, and withal exciting that occult fire of *Mars*, well known to the true Searchers of Nature; which, being assisted by the *Alcool* of Wine, is able to concoct the little immature portion to a due maturity.

*
NB

An Extract of a Letter of Mr. Lister to the Publisher, both enlarging and correcting his former Notes about Kermes; and withal insinuating his conjecture of Cochineil's being a sort of Kermes.

Sir,

WE must correct as well as enlarge our Notes concerning *Kermes**; and yet there will be much difficulty in resolving the question concerning the Original and Efficient of *Kermes*. These things are certain:

* Compare herewith, what was publish'd in No. 71. p. 2165. No. 72. p. 2177. especially No. 73. p. 2196.

1. That we have this year seen the very Gumm of the *Apricock* and *Cherry-lavrel-Trees* transudated, at least, standing in a Crystal-drop upon some (though very rarely) of the tops of these *Kermes*.

2. That they change colour from a yellow to a dark-brown: that they seem to be distended and to wax greater, and from soft, to become brittle.

3. That they are fill'd with a sort of *Mites*; that small powder (which I said to be Excrement,) being *Mites* as well as that *Liquamen* or softer pulp (which I took to be Bees-meat;) concerning both which particulars I am pretty well assur'd by my own, and also by my ingenious friend, Dr. Johnson of *Pomfret's* more accurat Microscopical Observations.

C g g g g

4. That

4. That the Bee-grubbs actually feed on Mites, there being no other food for them.

5. That there are other *Species* of Bees or Wasps besides those by me described; which are sometimes found to make these Mites their food: Dr. *Johnson* having open'd one Husk, with one only large Maggot in it.

6. That there are probably different sorts of Mites in these Husks, making possibly different *species* of Kermes: For, some I have found to hold Carnation-colour'd Mites, enclosed in a fine white Cotton, the whole Husk starting from the Twigg, shrivelling up, and serving only for a Cap or Cover to that company of Mites. Other Mites I have seen white, and (which is most usual) the Husks continuing intire and not coming away from the Twigg they adhere to, and but little Cotton at the bottom. Those of the first sort are the white Cob-webbs on the Vine, described by Mr. *Hook Micrograph. Obs.* 56.

7. That the shrivell'd Cap to be found upon the Mites inclosed in Cotton, as also the whole Husk it self, if taken early in *April*, while soft, will, dried in the Sun, shrink into the very figure of *Cochineil*: Whence we guess, that *Cochineil* may be a sort of *Kermes*, taken thus early and sun-dried.

Hitherto this Summers Notes concerning *Kermes*. This advantage at least we may have by them; that the account, taken from M. *Verney* by Dr. *Croon*, and

See Numb. 20. p. 362.

publish't in one of the *Transactions*,* is made more intelligible: the small scarlet powder, there mention'd, being to be understood of those Mites; and they to be distinguish't from the Bee-grubbs, which are chang'd into the Skipping Fly, that is, the Bee, (for kind at least) by us described formerly, I am, &c. *York Octob. 9. 1671.*

An Extract of a Letter Written to the Publisher by Mr. Thomas Platt, from Florence, August 6. 1672. concerning some Experiments, there made upon Vipers, since Monsr. Charas his Reply to the Letter written by Signor Francesco Redi to Monsieur Bourdelot and Monsieur Morus.

Sir,

I shall begin with telling you, that in a Conversation last Winter, where I had the good fortune to make one of the number, the discourse was of an Opinion of M. *Dela Chambre*, who,

to prove that the Spirits are animated, alledges, among other arguments, their Aptness to discern; by which he supposes, that in the heat of their anger they gather the Poison from the several parts of the blood, and therewith convey themselves to the teeth of the irritated animal, from whence they are afterwards transfused into the wound by biting. This conceit was by some of the Company received with much applause, because they knew, how difficult a thing it was, to come to an explanation of that poison, which *M. Dela Chambre* makes mention of in general, That the spirits proceed from the Blood of the irritated animal. So they agreed, *paucis mutatis*, hence to frame a new *Hypothesis*, saying, That such poison is nothing else but a new and malignant activity of the same Spirits whilst they are vexed and bent towards revenge; asserting the truth of such Ideal effects with divers examples, as that of the Toad, the Weesel, the Mad Dog, the Spider of *Puglia*, &c. which were all found very weak and un-concluding.

Wherefore most of the Gentlemen did incline to entertain *Monf. Dela Chambre's* first fundamental Opinion, since at least that supposes, That those Animals, that poison by their biting, have already a real poyson within themselves, and that Anger works no other effect, but to gather all the venomous parts together in one particular place, whence they may easily be instill'd into the wounds, made by the teeth.

For all this, (as it most commonly happens in such discourses,) every one remain'd in his own Opinion; and mention having been made of that of *Signor Redi's*, held in his Book of *Vipers*, which for several years passes in this Country almost for an undoubted truth, *viz.* That the *Vipers* poison consists in some thing, incompatible with this new allay of *M. dela Chambre's* opinion, reduced to the irritated Spirits, though not with that of his, which is taken purely from its first grounds: This gave occasion to a new debate concerning the validity of *Signor Redi's* Assertion, so generally received here: some saying, it would do well to examine the grounds of it. Upon this it was resolved, that all might be satisfied, to come to a tryal as soon as the Spring would give leave to *Vipers* to appear abroad.

Now, Sir, you must know, that being at the house of *Sign. Magalotti* on the 2d of June last, there came *Dr. Francini*, who had formerly been one of the most resolute Assertors of this

opinion of Signor *Redi* concerning the Poison of Vipers ; and being come he sent to his lodging for a Box, in which there were a great many heads cut off, that morning, of Vipers lately come from *Naples*. He immediately desired to have some Animals to begin his Experiments upon ; but there being at that time no other company with Signor *Magalotti* but his brother and I, it was thought fit to stay till next morning, that those Gentlemen, who were at the dispute last Winter, might be present ; as it fell out they were.

I, that had not so much patience, desired the Doctor to make at least one experiment ; which being granted, Signor *Magalotti* was pleased to send to the publick Market for a couple of Pigeons, to be sure of having some, that were not prevented by any Antidote. The Pigeons being come, the first was wounded with the Teeth of a Vipers head that had been cut off about 7 or 8 a clock the same morning. The way of making the wound was, by thrusting twice the Master-teeth into the fleshy part of the Pigeons breast, till such time as pressing the upper part of the Jaw, the two little bladders, that serve as gums to the teeth, did empty out upon the wound some of that yellow liquor, which here is suppos'd to be the true and only poison of the Viper. This Pigeon being thus bit, and set upon the ground, began to stagger immediately, and dyed in less then 3 or 4 minutes. The second Pigeon was wounded in the same manner ; but at the first wound there only entered one of the teeth, which brought forth a great deal of blood ; the second time they both enter'd, and this had the same fate, with this difference only, that he languish'd half a quarter of an hour.

The next morning there met at Signor *Magalotti's* Chambers, besides the company of the day before, Signor *Carlo Dati*, Sign. *Vincenzo Viviani*, Sign. *Paolo dell Ara*. Dr. *Savona*, Dr. *Neri*, Dr. *Fabrini*, and some others. Whereupon six Pigeons and a Cock having been brought ; the first thing that Dr. *Francini* did, was, to thrust several thorns of Rose-shrubbs into the breast of one of those Pigeons, to manifest, that such accidents, as might befall those that should be wounded by the Teeth of the dead Vipers, were not meerly caused by the wound. And whereas one of the company began to make some nice reflexions, and to take some of the heads to measure the just proportions of their

their teeth, to see what difference there might be betwixt them and the thorns, this made the Doctor loose patience; and soon taking a pin, which was none of the least, he gave to the first Pigeon, that he could lay hands on, a very deep wound in the breast, which no sooner was got free but began to leap & frisk about the room, as if it had not been concern'd in the least.

After this, they began in good earnest. For another Pigeon was taken and bit in the breast by both the Master-teeth of a Vipers head, that had been cut off the morning before; the execution being exactly like that of the day before. The effect was, that the Pigeon had the same shaking fits; after which falling upon his belly he died, giving signes a little before of a painful Agony, by his often gaping. His end was not only very sensible to him, but also more tedious than that of the other day; for, this lived 5 or 6 minutes after his wound. Another having been serv'd after the same manner with another head, had the like accidents, and died within a quarter of an hour: This Observation was made on this other, that his wound let out a great deal of blood; whereas not so much as one drop was seen to come out of any of the others.

All this appearing as yet but little to the Doctor, to exclude the doctrine of Spirits, which now began to loose ground after so many experiments of *Dead Vipers* heads; he took three stalks out of a Broom, and having smoothed them, and sharpn'd them at the ends after the manner of a Lancet, he drew from the gums of several heads enough of that yellow juice to dawbe two of those stalkes; which, being thus moistned with that liquor, were both put into the breasts of two Pigeons, and there left; the like having been done to another with the 3^d stalk not cover'd with that juice, which was at least one third part bigger and longer than the other two. In a word, the two first died within 4 or 5 minutes, and the last continues to this very day in Signor *Magalotti's* Pigeon-house as brisk and as fat as ever; his wound in his breast, instead of having caused an Inflammation, is now almost perfectly healed.

Whilst these Experiments were making, it came into the heads of some to try another, upon the relation that Sign. *Paolo dell' Ara* (lately come from *Paris*) had made; which was, that some had asserted there, that, to swallow a Vipers head was a most certain Preservative and Remedy against the biting of a Viper.

Viper. Dr. *Francini* smiled at that phancy ; but to give full satisfaction about it, he made two experiments. The one was, by making the Cock that was there to swallow a Vipers head, and then causing him to be well bitten in both thighs by a live one. But the Cock continuing some time before he gave any signs of sickness ; not to loose time, he pass'd to the other experiment, by thrusting the Teeth of a dead Vipers head into another pigeon, that had before got down one of those heads into his belly. The conclusion was, that both dyed, the Cock within a quarter of an hour, & the Pigeon in less than 4 minutes.

The news of these Experiments made many persons curious to see them perform'd once more ; so that, some few days after, a rendezvous was made in Sign. *Magalotti's* Garden, where, besides the forenamed persons, met Mr. *Thomas Frederick*, Mr. *John Godscall* (two English Gentlemen,) Abbot *Strozzi* (his Most Christian Majesties Publick Minister in this Court,) Sign. *Paolo Falconieri* (first Gentleman of the Bed. chamber to the G. Duke) Sign. *Luigi del Riccio*, Mons. *Pelletier*, Mons. *Morelle* (the one Physitian, and the other Chirurgion to the G. Dutches,) Dr. *Gornia* Physitian in Ordinary to his Highness, Dr. *Bellini* Professor of Anatomy at *Pisa*, Sign. *Lorenzo Lorenzini* a Mathematician, and Sign. *Pietro Salvetti*.

But by the by, give me leave to tell you (for some diversion,) that this Sign. *Salvetti*, who is one of the G. Dukes Musicians, & plays on all Bow-Instruments, invented about 4 years ago a New tuning of the Antient *Lira Viol* with the usual 13 strings ; by means of which tuning it is rendred wholly perfect, so that you may express upon it all Concords, Discords, and also the imperfect Concords, as seavenths, sixths, &c. as well as upon any Virginal that hath the quarters of Notes upon it. 'Tis true, 'tis only for Melancholly and passionat matter, and not for diversion, as is the proper nature of the *Lira*. I shall only add, that with the abovesaid tuning he ascends in *Alte* as high as G, Sol, Re, Ut ; and descends as low as double C, Sol, fa, ut ; and can make every where the same Concords as above.

This same person having applied himself to the study of the Mathematicks, and particularly about the *Proportions* of Harmony, relating to his profession of Musick, began to delight himself in *Opticks* and other parts : And not being content with the Theory, he went on to put it in practice by making Telescopes of

of divers sizes, as also Microscopes, in imitation of those of *Divini* and *Campani*. And I can tell you, that he lately shew'd one of his Microscopes to the G. Duke, which was judged by all much better than any of the best his Highness hath; and I was an eye-witness to this, that for magnifying, defining, and clearness, it was found very excellent. The same day he likewise shew'd his Highness a little Prospective Glass, made according to Mr. *Newtons* new Invention; and though this was but the first, and was not above half a foot long, it had the same effect of one of two. He is now making another after the conceit of M. *Cassegrain*, though he agrees not with him in making convex the little Speculum, which one looks into through the Eye glass; but believes, the French Author only deviled that to disguise as much as was possible his pretended New Invention, which he endeavors to make anterior to Mr. *Newtons* most noble one. For the rest, he thinks he hath found a way of making Objects seem right with one only glass.

But, to return from this digression to our first discourse, you may take notice, that the Assembly at Signor *Magalotti's*, having been first inform'd by Dr. *Francini* of the grounds of this dispute and of the former Observations, he began the same experiments by causing 2 Pigeons to be bit by a Vipers head that had been dead above ten hours, in such a manner that by pressing the gums some of that yellow liquor might drop into the wound. They both died, one in 6 minutes, and the other in 8; and not being content with this, with another Vipers head they poison'd a Chicken, which died in 10 minutes. There appear'd afterwards another Pigeon, that had been wounded, many hours before, by a dead Vipers head; but it had been dead so long, that the liquor, quite dried up in the gums, was become so hard, that for all the squeezing of it nothing would come to the teeth; whence this Pigeon was very well: And Dr. *Francini* having caused the same bird to be bit again by the same dried head, it had after a little fluttering with his wings, whilst the pain of the biting lasted, no other harm.

A live Viper then being taken, 4 Chickens were bit by it one after another. The two first, either because the liquor did not penetrate into the wound, or the blood expelled it, appear'd not to have any distemper. The 4th look'd as if it would dye presently; but a little after coming to himself he got clear off

off for that time. But the third, who seem'd at first to be very lively, dyed within an hour and an half.

There being afterwards a young Bitch brought in of a pretty size, she was bit twice by a live Viper in the middle of the hanging part of the ear: Whereupon she very soon began to give mortal signs, by staggering, vomiting and being convulsed; after which having a little recover'd her self, the same accidents return'd upon her, by which she was reduced to such a grievous condition, that four hours after her being bit she could not stir any more, and seem'd just as if she had been dead, holding out her tongue, and looking very ghastly, without any other sign of life than that of painful breathing; to which she added sometimes a faint barking and a languishing howling. In which condition she was still found next morning, only her respiration was yet weaker, and she appearing just a drawing to her end. It was observ'd, that no part of her body was swell'd, nor had any spot upon it. She had voided backward some matter of a very black colour, of which her hind parts being very foul, a swarm of Gnats and Wasps were devouring her alive: Which mov'd one of the servants of the house, to knock her in the head.

After this, there were bit two Capons and a Pullet by a fresh Viper, vexed a purpose; and, because they gave not then any signs of being ill, they were sent back to their coops, and there having continued well till evening, they were surpris'd at night by a distemper, which in all likelihood proceeded from the poison; for next morning one of the Capons and the Pullet were found dead.

I must not forget to tell you, that the last thing that was done, was, the sending to the Pigeon-house for that Pigeon, that had in his breast the stalk that had not been imbued by the yellow liquor; where he had been kept during all that interval of time, from the first experiments to these last; being now found by all not only very lively, but also in a thriving condition. The place of his wound being search't, the stalk was easily felt, and was, before the eyes of all the company, with a little pair of Pinchers drawn out.

This is, *Sir*, what I can confidently affirm to have been an eye-witness of; and it being not my business to make reflections upon these experiments, I leave that to you. I know, I have not said any thing but what will be most amply found in Sign. *Redi's* first and 2d. book; but that, which urged me to make this repetition, was the thoughts that it might be acceptable to you, to see his Assertions confirmed by the Testimonies of so many persons, that are the more able to be judges of them, because their understandings are such, that 'tis not possible to impose upon them.

If I may be so happy as to receive sometimes from you an account of the Curious performances of your famous *Royal Society*, I shall make use of that favour, to animate the *Virtuosi* here to do something that may not be unworthy of your knowledge: But before you afford me this honor, I must first beseech you to lay your commands on me, by the execution of which you shall plainly see, with how much reality I am &c.

Dr. John Wallis his Answer, by way of Letter to the Publisher,
to the Book, Entituled *Lux Mathematica*, &c. described in
Numb. 86. of these Tracts.

Clarissimo Doctissimoq; Viro.

Dom. Henrico Oldenburg, Soc. Regiæ Secretario, Johannes Wallis;
Geom. Prof. Oxon. Sal.

Clarissime Vir,

Vidi Ego, præteritâ septimanâ, Hobbii quem memoras librum novum, cui titulus *Lux Mathematica*. Quod autem Authore R. R. dicatur, factum credo, ut sit qui Hobbium collaudet, si non Alius, saltem aliis literis insignitus Idem, (*Roseti Repertor.*) Permitto, si placet, ut & Stricturas nostras dicas, Authore R. R. ut sit etiam R. R. *Roseti Refutator*.

Inter *Manifesta* sua, sunt & *Manifesti* Errores. Speciatim (ne multa memorem,) cum idem esse vult, *Decem Pedes*, in *Decem Pedes*, atq; simpliciter in *Decem*, Multiplicare; & quæ hujus sunt similia non pauca. Quasi idem esset, *Decem Centurias* in *Decem* ducere, atq; in *Decem Centurias*, seu, *Duas Centesimas* in *Duas Centesimas*, idem atq; in *duo*; quod ille facit p. 33. l. 27. *Quadratum* (inquit) à duabus centesimis æquale est quatuor centesimis: (cum dicendum erat, *Quatuor Decies-millesimis*.) Quod quàm sit absurdum si nesciat, per me licet ignoret.

Sin displiceat sibi suum *Multiplicare*: Quis Hobbium jussit, *Multiplicare* (de lineis) importunè dicere (quò nugis suis locus esset) quod *Ducere* dicunt alii; vel, si quando *Multiplicare* (sensu laxiore, sed satis intellecto,) tantundem volunt.

Quod *Controversiam primam*, quam vocat, spectat, ex Hobbii Documento quinto desumptum; abundè refutavi in Hobbio debitâ *Correctione* Sect. 5. Sin adhuc nesciat, $\frac{1}{3} + \frac{1}{12}$ minus esse quàm $\frac{1}{3} + \frac{1}{6}$ (aut illius ad 1, rationem minorem esse, quàm hujus,) pergat nescire.

De *Controversia Secunda*; quid sit *Ratio*, quidq; hanc inter & *Fractionem* conveniat aut intersit, abundè ostendi, (tum alibi, tum) in Hobbio Heauton-timorumeno, p. 49, &c. ubi Hobbio Dialogo quarto responsum est. Permitto tamen ut ille etiamnum non intelligat.

Tertiam quod spectat; De *Parabola* & *Parabolastris*, quas habuit Hobbii propositiones *Veras*, nec suas esse, nec ab eo intellectas, (sed & unde habuerit) ostendi, in *Elencho Geometriæ Hobbiana* p. 83, 84. item 133, 134. (quas *Falsas* habet, non nego quin suæ sint.) Quàm bellè demonstraverit, ibidem ostendi (à pag. 64. ad 83,) ad Hobbii cap. 17. Ut autem suas ipse demonstrationes illas legitimas judicet, sibiq; adjudicet, etiamnum permitto: nempe, ut similia sint labra lactucis. Quid Ego de his, sive in *Arithmetica Infinitorum*, sive in *Commercio Epistolico*, sive in *Tractato de Motu*, tradidi; ex scriptis meis sciscas velim, (ubi & quid dixi, & quare, videas: non ex Hobbio narrante. Quod & ubique

biq; intellectum velim ; eiq; de me referenti derogandam fidem, subleſtæ fidei ſæpius depreheſſo.

Quòd autem, *Triangulum* (verbi gratiâ) *Parabolamve*, aliâmvē *Figuram*, etiam *Truncatam*, complentes parallelas Rectas, & eſſe numero infinitas, & earum tamen tum primam, tum ultimam, datam eſſe, ſine ſolæciſmo dici poſſit (obſtrepente licet Hobbio) ſatis ſum ſecurus.

Ad *Quartam* quod attinet; quid *Ductum Rectæ in Rectam*, *Numeriq; in Numerum*, adeoq; *Latus & Radicem*, interſit conveniâtve; jam olim oſtenderam, *Opere Arithmetico*. cap. 18. 22. 25. & alibi. Item, quo ſenſu *Multiplicatio Augēt Multiplicatum*. Ut non ſit opus ab Hobbio (horum nescio) jam edoceri.

Quòd 1 per 1 multiplicari non poſſit, propterea quod quicquid multiplicatur ſit plura; à Puero dicendum erat, qui nondum didicerat, quid ſit multiplicare per numerum fractum. Sed, Quòd decem (pedales) lineæ (non in 10, ſed) in ſe ductæ, faciunt 100 (pedales) Lineas, non 100 Quadrata; quodq; ſi queratur, quoties ſunt 10 A in 100 A, Quotiens erit (non 10, ſed) 10 A; quodq; 100 A B, ſit id quod ſit ex 10 AB in 10 AB; (& quæ ſunt huiusmodi;) dicenda erant (non à puero, ſed) ab Hobbio ſolo. Et, *Algebram univerſam continere ſe debere intra fines Arithmetica*, neq; omnino audiendam in cauſa Geometrica; eſt, nescientis quid ſit Algebra.

Ad *Quintam* quod habet; Quod ſcil. *Punctum* (Mathematicum) ſit Quantum, & partes habeat; Lineaq; Latitudinem, &c. Obtinere debet in Geometria Hobbiana; utpote ſine quo ipſius Pſeudo-graphemata non procedunt, (ſed neq; hoc conſeſſo:) non in Euclidea.

Dum verò ait, *Walliſium dicere*, Minorem eſſe (non Aequalem) Angulum Semicirculi Recto Rectilineo; &, *Angulum Contactus dictum*, quantum eſſe; & quidem, *ejuſdem generis quantum cum Rectilineo*; (meq; hæc authoritate Clavii docuiſſe, pag. 38.) Quicunq; vel leviter inſpexerit meum *De Angulo Contactus & Semicirculi Tractatum*, (quem ex profeſſo tueri horum contraria, eoq; nomine editum, res eſt notoria;) dubitare non poterit, quàm ſit ſubleſtæ fidei R. R.

In Sexta, Septima, & quæ ſequuntur; reponit ex Roſeto ſuo (eſto enim quamcunq; Roſetum,) falſas quas dudum refutavi propoſitiones; (quaſi quidem, ſæpius repetendo, evaſuræ tandem forent Veræ.) Refutationem jam habes editam in *Transact. Philoſophicis* pro menſibus Julio & Septembri Anni 1671. Nec opus erit, eam toties repetere, quoties ille reponit ſua Nugamenta. Si ſibi nondum ſatiſfactum eſſe queritur, Ego illud non moror; non enim reuſo quin eas ille pro Veris habeat: Alii ne ſic exiſtiment, procul omni metu ſumus.

Dicet forſan; Se vel demonstrationes (pridem peccantes) emendaſſe vel adornatſe novas. (Atq; id quidem, in nonnullis, conatus eſt; in multis, ne ſic quidem.) Verum hoc non facit, ut ergo novâ Refutatione ſit opus; quippe, cùm antea, non modò non eſſe demonstrationes oſtenderim, ſed & falſas eſſe demonſtraverim, nullo unquam Novæ Demonſtrationis prætextu fieri poteſt ut evadant Veræ.

Si tamen Tu petis, (nam Hobbii hac in re nullam habendam eſſe rationem

tionem autumo ;) ut ubi novæ, quas subornat, ~~addam~~ peccent, Tibi saltem indicavero, (ne id sollicitus inquiras ipse;) ex multis pauca (sed quæ toti subvertendo operi sufficiant) ubi supra omnem medellam peccatur, attingam breviter.

Ad Controversiam *Sextam*; Lepidam habes Constructionem, & *Hobbio* dignam : Nempe, si (pag. 13. lin. 6, & 9.) pro, *Radio DA* descriptus arcus *AX* est arcus 30 graduum, posuisset *Punctum X* ubi vis, in *GH* re-

Vid. Tab. II.
Fig. I.

Etâ, (etiam utcumq; productâ;) demonstratio perinde sequeretur atq; nunc; ne verbulo quidem mutato. Quod legenti statim patebit; (sal-

tem inspicere hanc Figuram; ubi sumpto *X*, non *Ax* arcu, sed in ipso puncto *G*, non minus succedunt omnia.) Ut possit esse *EX* quantumvis longa. (Et *Hobbins*, quantumvis ridiculus; nempe qui hoc ipsum pridem monitus non potuit secundis curis cavere.) Est quidem Figura nostra, ab scopo suo, satis enormis; sed huic pariter atq; suæ convenit sua demonstratio.

In Demonstratione; Falsum illud (pag. 14. l. 5.) *Erunt Fß & X r æquales*. (Sunt quidem Parallelæ, sed non æquales.) Adeoq; falsa quæ sequuntur omnia hinc pendentia.

Ad *Septimam*; Objicere me dicit, quòd dixerit *Hobbins* (non quidem dixisse objiciebam, sed quasi sic esset arguisse insinuabam;) *Chordas* (in eodem circulo) suis arcubus esse proportionales. Negat se quod objicitur invenire posse. Luscus sanè vidisset. Indicaveram enim paginam, versumq; ipsum, locorum saltem *Quatuor* ubi hoc fit.

Curvedinem quod spectat; dicit *Wallisius*, in perimetris (vel similibus arcubus) circulorum Majoris atq; minoris, tantundem esse curvedinis; sed hîc in Minori, illîc in Majori, Longitudine: (pariter atq; in aliis Polygonis:) Adeoq; Minoris *Curvedinem* esse, specie seu gradu Majorem, (propter tantundem curvitatatis in minori longitudine,) non quantitate Majorem. Id quod in aliis qualitatibus occurrit. *Tantundem* Caloris, in minore mole facit intensius Calidum, sed non plus caloris; h. e. Calorem fieri gradu majorem, sed non majorem quantitate. Sic *Hydrargyri* unum Pondo, quàm unum Pondo *Stanni*, *Gravedinem* habet (quod ajunt) specie majorem, ut ut *Quantitate* æqualem; propter tantundem Ponderis in minore Mole. Quæ *Hobbins* de his nugatus est (& nunc & olim) apud ipsum videas; (neq; enim tanti est ut repetam.) Nescit ille inter *Curvedinem* quantitate majorem, & majorem gradu. distinguere: ut ut eum illud ego expressè docueram, in *Hobbio Heaton-timorumeno*, pag. 98. & alibi.

Controversia *Octava*, *Cramben* reponit, toties recoctam, & toties refutatam, ut jam planè sit rancida. Quam nunc subornat, demonstratio peccat saltem in eo (& quæ hinc dependent) pag. 17. l. 28. ubi dicitur, non possunt esse; pro quo dicendum erat, non possunt non esse. Sed & quæ sequuntur putida sunt.

In *Nona*, peccatur (ut alibi, sic) potissimum pag. 19. l. 29, 30, 31. Ubi probandum susceperat, puncta *P, p.* coincidere. Sensus planè turbidus est, sed, ad mentem suam restitutus, hic erit; Quoniam Angulus *pDC* est $\frac{2}{12}$ unius recti; atq; *PAR* & *ARP*, uterq; $\frac{3}{12}$ unius recti: Dp cum

RP alicubi faciet $\frac{1}{2}$ recti, atq; cum AP $\frac{1}{2}$ recti; qui simul sunt $\frac{1}{2}$ recti, quantus est APR: (quod verum est.) At (inquit) id fieri non potest nisi Dp,

RP, concurrant in ipso P Puncto, ubi concurrunt AP, RP. I. Vide Tab. II. mō, inquamego, fieri potest (quod res est) Dp secet Fig. II.

R P infra P (puta in Q) & post occurrat productæ AP supra P (puta in O) triangulum formans OPQ; quippe cujus duo anguli interni ad Q & O ($\frac{1}{2}$ recti & $\frac{1}{2}$ recti) simul sumpti æquantur externo opposito APR = $\frac{1}{2}$ recti; non minus quàm si (quod ille somniat) O, P, Q, essent idem punctum.

Ad Decimam; hoc eum malè habet, quòd dixerim, Non mirandum est, Hobbium, his utentem methodis, talem nobis procudere Geometriam; utpote cui circinus est Calculo accuratior: dicitq; in verbis illis nihil se videre in illam sententiam. Tu iudex esto, ubi, inter alia, hæc legeris: Multè probabilius pronuntiabit à mensura Mensor diligens, quàm qui pronuntiabit à falsis principiis, (Logicam sive Logisticam vult, quam modò ut incertam condemnauerat; atq; in causa Geometrica non audiendam toties ingeminat: quod ne dubites, sic progreditur,) & Algebristam, h. e. Arithmeticum contra Mensuratum disputantem meritò iridebit. Aliaq; multa in hunc sensum.

Quod sequitur; Hobbesius in eo peccatum esse putat; putat, inquam, non affirmat: Nihili est; nam ne quidem, si affirmasset, eò magis crederem.

Ad Undecimam, (ubi omnia tam miserè putida fuerant, ut abstinere digitos satius duxerit, quàm particularem vel definitionem vel emendationem aggredi,) satis habet insimulare, Argumentum à Radicibus non valere, verasque esse (se iudice,) quas ego propositiones falsas esse demonstraveram. Atque similiter ad controu. Decimam tertiam seu Ultimam.

Ad Duodecimam, (ubi multus est,) Falsum illud in limine pag. 23. l. 1. (unde dependent omnia) Rectam Dz equalem esse arcui C L.

Sed porrò lin. 29. ait, addito PQL, ubi dicendum erat addito CYP. Quo emendato, non habent reliqua quo nitantur.

Insuper, pag. 24. l. 26. hæc habet; Habemus ergo Equationem hanc $2CYP - DPV = DPV - 2PQL$. (esto. Quid inde?) Quare, cum mediæ quantitates, $-DPV$ & DPV simul additæ æquales sint nihilo, $2CYP$ & $2PQL$ faciunt nihil. Sunt ergo CYP & PQL trilinea equalia: (nempe; æqualium alteri si quid addas, quò fiat quantumvis magnum; alteri tantundem demas, quò fiat quantumvis exiguum, aut etiam minus quàm nihil: Tum quid? Num aggregatum illud huic residuo erit æquale? aut ulla hinc eorum æqualitas colligenda? Videamus; Habemus equationem hanc; $10 - 8 = 8 - 6$; quare, cum mediæ quantitates -8 & 8 simul additæ æquales sint nihilo; 10 & -6 faciunt nihil. Sunt ergo 10 & 6 , item horum dimidia, 5 & 3 , equalia. Sic utiq; vult Hobbesius.) Putasne tu, ad hæc Refutatione opus esse?

Deinde, (ne singulis insistam) pag. 25. l. 25. Quoniam ergo, &c. Usq; ad Inter Dk & DZ, &c. l. 33. sunt falsa omnia.

Tum illud lin. 35. DC ad Dk Duplicatam esse rationis DZ ad DC, (quorum, ex constructione, altera est Majoris, altera Minoris, inæqualitatis ratio: Hobbium sapit. Item

Item lin. 34. &c. Quoniam ratio DC ad Dz duplicata est rationis Dz ad De, erunt, inquit, (imò, inquam, propterea non erunt) De, Dz, DC, continuè proportionales.

Interim (ut dicta sua paucis connectam;) Erit (inquit. lin. 11.) Dh, media proportionalis inter DC & Dk. (Ergò DC, Dh, Dk, continuè proportionales :) Item (lin. 33.) inter Dk & Dz sumatur media proportionalis, De, (Ergò Dz, De, Dk, continuè proportionales ; & Dz ad Dk duplicata rationis Dz ad De :) Sed & (lin. 34.) DC ad Dz est Dupl. ratio rationis Dz ad De ; Sunt ergò DC ad Dz, & Dz ad Dk, eadem ratio ; adeòq; DC, Dz, Dk, continuè proportionales.) Sed & erant (ut jam dictum est) DC, Dh, Dk, continuè proportionales.) Ergò Dh, Dz, invicem æquales : (quarum illa, per constructionem, ponitur media proportionalis ; hæc, duarum mediarum major, inter easdem DC, Dk :) Item (propter, tum De, Dz, DC, continuè proportionales, l. 34. tum Dk, Dz, DC, continuè proportionales, per jam dicta,) æquales erunt De & Dk (quarum illa, per constructionem, & media proportionalis inter hanc & hujus duplam.) Nempe, si demonstrationibus Hobbianis standum sit.

Non mirum itaq; quòd, ad hæc quòd viam strueret, (pag. 24. l. 37) Invalidam pronunciaverit tum Demonstrationem Archimedis, tum Euclidis Propositionem, 20. El. 6. (Quadratorum rationem duplicatam esse rationis Laterum.) Repugnat enim, inquit, non modò longitudini Circumferentie Circuli inventæ ab Hobbesio ; sed etiam prop. 19. Roseti, qua inventæ sunt duæ media proportionales inter rectam datam & ipsius dimidiam. Vides itaq; in quo statu sunt ipsius tum Quadratura Circuli, cum Duplicatio Cubi, (totumq; simul Rosetum ejus :) & quantâ strage opus est, quò sibi sternat viam.

Necdum finitum est, sed probatu adhuc opus est, (quod & probaturum se suscipit, & si qua fides, probasse,) Differentiam inter rectam, & maximam mediarum duarum, inter se & sui semissem, equalem esse differentie inter Mediam inter duas extremas & Minimam : (nempe $1L\sqrt{c^{\frac{1}{2}}} = \sqrt{q^{\frac{1}{2}} - \frac{1}{2}}$.) Sed forti huic opus est ventriculo qui hæc concoquat : Meus certè ne devorare quidem potis est, nedum concoquere. Fac tu periculum. Ad ea duo præsertim respice, (inspecto suo Schemate, quod non tanti est ut repetam,) pag. 27 l. 25. Sunt ergò Bi, ic, cE, continuè proportionales ; (nempe, Quia DB. DC :: Bi. ic ; & Di, DE :: ic. cE. Ergò Bi, ic, cE :: ; cum ne dictum quidem sit, nedum demonstratum, DB. DC, & Di, DE, proportionales esse.) Et lin. 28. Quare recta DE, dividit angulum BDC bifariam ; (nempe quia, non Cru- ra DB, DC, sed aliæ quædam rectæ, AB, AE, sunt in eadem ratione cum basis segmentis BE, EC.) Quippe si hæc duo ferre potes, spes est, ut Bovem tandem feras, qui Vitulum tuleris.

Ubi hæc peregeris ; ad eas, quæ sequuntur, Propositiones quinque cum veneris ; inspecto iterum suo Schemate, respice, num spes sit demonstrandi, Rectas omnes à puncto N ductas, & inter AT transeuntes, in eadem ratione secare arcum BG, & IG sinum ejus, rectasque huic parallelas AT, Bq, &c. De quo si non despondeas, interrurus ad conspectum monstri,

monstri, propius admotus, respice ad illa pag. 29. l. 32, &c. ubi, trisecto arcu BG, in f. i, rectâq; AT, in β , X; præsumit, (quoniam probatu erat impossibile) N β f esse unam rectam, itémque NXi; quod falsum est: quippe recta NF, per β non transibit, (adeoq; nec erunt quod ille somniat, A β , bf, in ratione NA ad Nb; neq; N β producta transibit per f.) sed neq; NX producta transibit per i; (aut Ni, per X.) Et similiter de sectionum punctis reliquis. Atque hac unâ strage simul corruunt hæ Propositiones *Quinque*: (Adeoq; nec dabitur: *Recta Arcui Quadrantali equalis*; nec *Dividetur Angelus in ratione data*; nec *Dato Arcui invenietur equalis recta*; nec *Datæ rectæ æqualis Arcus*; nec *Inscribetur Circulo Polygonum Regulare, datum habens numerum Laterum*: Proh dolor!) Nos, quid de hujusmodi nugis sentiendum sit, (Rectas omnes, ab uno aliquo puncto ductas, in eisdem rationibus secare posse curvam aliquam, atq; expositam rectam; & quæ sunt hujusmodi;) jam olim ostendimus; non enim vel semel, vel nunc primum, sed olim & sæpius eadem oberravit chorda,) in *Elencho Geometriae Hobbiana*, pag. 97, 98, 99; 103, 104; 111, 112, 113, &c. & *Hobbio Heanton timor*. p. 119, 120. & alibi.

Tandem (quòd mirum est) demonstrandum suscipit unam Propositionem Veram; sed quam ille mallet Falsam; quippe id ejus intererat vel maximè:) Nempe, *Quòd quatuor quintæ radii non est major duarum mediarum inter radium, & Semi-radium*. Ecquis dixit esse? Certè, si non *Hobbius*, nemo alius. Nam $\frac{4}{5}R = \sqrt[3]{c\frac{64}{125}R^3} > \sqrt[3]{c\frac{1}{2}R^3}$. Sed videamus, quàm ille hoc demonstret Bellè. Nempe hoc ut probet, pag. 33, *Est* (inquit *lin. 12.*) *Cubus a DC 1000 quorum Cubus a Dt est 512*. Mox autem (*lin. 22.*) *Cub. DC & Dt, sive 512. & 256*; qui neque iidem sunt neque in eadem ratione, cum 1000 & 512. Paulò pòst (*lin. 24. &c.*) *Non est* (inquit) *recta Dt* (nempe $\frac{4}{5}$ DC) *media proportionalis inter totam DC & ejus dimidiam, sed eâ major*; (Rectè quidem; sed quanto major?) *quantum est duodecem millesimæ partes Cubi à totâ DC*; (nempe duarum Rectarum differentia, est Corpus Solidum;) *sive quantus est Cubus a duabus centesimis ipsius DC* (pro eodem utique habet, $\frac{1}{1000}$ Cubi, & Cubum ex $\frac{2}{100}$, h. e. $\frac{8}{1000000}$ Cubi: sed pergit,) *Nam Quadratum à duabus Centesimis rectæ cujuscunque, æquale est quatuor Centesimis quadrati totius*; (Nempe quadratum à $\frac{2}{100}$, seu $\frac{4}{10000}$, facit ille $\frac{4}{10000}$: (Et Quadratum diagonalis ejus (utpote duplum quadrati Lateris) potest 8 quorum duæ centesimæ potest 4. Itaq; super quadratum ex illis duabus centesimis si construatur Cubus, Cubi istius diameter potest 12 quorum duæ centesimæ Radii potest 4. (Quorsum hæc? inquires; nempe, inquit,) *Demonstravimus ergo, quatuor quintas semidiametri, duarum mediarum inter Radium & Semi-radium majore, majus esse; & quanto.* (Nempe, toto corpore solido, quod sit $\frac{12}{1000}$ Cubi ex Radio; idemque, si credes, æquale Cubo ex $\frac{2}{100}$ Radii.) *Spectatum admissi risum teneatis? Sin hæc placeant, ejusdem farinae sequuntur ibidem plura, modò vacat legere.*

Sed esto. Dabimus enim (utut non ab illo demonstratum) verum esse; nempe, $\frac{4}{5}$ Radii, non esse majorem duarum mediarum inter Radium & Semi-Radium. Quid porro?

Nempe; cum non sint æquales Dt, quæ est $\frac{4}{5}$ Radii, & Dz duarum illarum mediarum major, (quod se demonstrasse putat;) suâ tamen intersit ut harum Quadrata sint æqualia; quorum unius latus tr , alterius zc ; (secus enim, ruituram videt totam suam machinam, quæ hæc duo quadrata pro eodem habet;) ostendendum suscipit (pag. 35.) *latitudinem habere* suas rectas, & quantam eam esse oporteat; tantam scil. (saltem non minorem) quanta est tz , (duarum Dt, Dz, differentia;) quò possint (parallelæ) tr , ze , pro eodem ejusdem quadrati Latere haberi. (Quæ quidem tz , major minorve erit prout major minorve est expositus Radius: Puta si ponatur Radius 200 pedes, erit tz plusquàm unus pes, seu $\frac{1}{4}$ proximè: si Radius 200 milliaria, erit tz plusquàm unum milliare. Verùm si, (quod ille etiam vult) sumenda sit Dc æqualis ipsi DF, erit Dz adhuc minor; ipsaq; ze (lineæ latitudo) *milliaria duo* (proximè.) Nam posito $DC = 200$, erit $\frac{4}{5}$ ejusdem Dt = 160; & major duarum mediarum Dz = $158\frac{2}{5}$ ferè: Sed quam ille descripsit Dz, = 158 proximè: Ut sit (lineæ latitudo) zt , partes 2, qualium DC est 200; adeoque centesima pars radii: Quæ itaque non est adeò minutula, quid (vel Circino magistro) in Schemate non magno distingui possit, si foret *Hobbius* saltem *Mensor diligens*. Egregium Commentum, & *Hobbio* dignum! Quod quidem nisi concedamus, (pag. 32.l.6.) *Sequetur*, inquit, *manifestè* (quoniam *longitudo sine latitudine nihil est*,) Latus quadrati esse nihil, h.e. nullum esse quadrati latus. Vid. Tab. II. Fig. III.

Atque hæc sunt illa, *Hobbesii Inventa in Geometria* (si credes) multa, nova, excelsa, clara, utilia. Hæc ea sunt, propter quæ (utut verum sit, nec auctoritatem, nec rationem in Mathematicis *Hobbesii*, apud Anglos multum valere;) *Extra*, legitur, intelligitur, laudatur. Sed ubi terrarum est illud *Extra*? Imò talia sunt, inquit, ut nec ætas prior majora vidit, nec futura confutabit aut extinguet. Tu, credo, aliter judicabis.

Ejusdem

Ejusdem Doctoris *WALLIS*

Non-nulla,

De Centro Gravitatis Hyperbolæ,
Prægressæ Epistolæ subnexa.

T Andem verò, ne nihil habeas præter Confutatum Hobbium, (quæ forte non tanti res est, ut de ea multum sis sollicitus ;) libet hic annectere, De Centro Gravitatis Hyperboles nonnihil ; (præterito Anno conscriptum ;) Miscellaneis illis, si placet. subjungendum, quæ habemus ad Prop. I. Cap. XV. De Motu. Nempe, pag. 753. l. 26. ibidem.

Post §. 10. Hæc addantur.

II. Etiam hoc addo Spatii Hyperbolici, sive interioris sive exterioris, non quidem ipsum Gravitatis Centrum, sed Rectam in quâ est, seu Axem Æquilibrii exhiberi posse, etiam si ignoretur Plani Magnitudo.

Vid. Tab.
II. Fig. 4.

Est enim exposita Hyperbolæ HhV , Centrum A , axis AX , vertex V , latus rectum L , axis transversus $T=2S$, axes intercepti $VD=D$, $Vd=d$, ordinatim-applicata $HD=H$, $hd=h$, axis-conjugatus $A\Delta$, ad quem ordinatim-applicata $H\Delta=K$, $h\delta=k$, asymptotarum alteri $A\sigma$ parallela $HS=B$ ad alteram $AS=A$ ordinatim-applicetur, & VO ad $AO=E$, & hs ad As ; atq; intelligatur $S A\sigma$ angulus rectus ; sitque $OS (=A-E) = O$.

Sunt (propter $h = \sqrt{\frac{1}{2} L d + \frac{1}{4} d^2}$:) ordinatarum ad axem semi-quadrata, seu momenta respectu AD , $\frac{1}{2} L d + \frac{1}{4} d^2$; & (propter $Omn : d, = \frac{1}{2} D^2$, & $Omn . d^2, = \frac{1}{3} D^3$), simul omnia, seu Momentum totius HVD respectu AX , $\frac{1}{4} L D^2 + \frac{1}{6} D^3$.

Idem (propter $k = \sqrt{\frac{1}{2} S^2 + \frac{1}{4} h^2}$:) ordinatarum ad axem conjugatum semi-quadrata, seu momenta respectu $A\Delta$, $\frac{1}{2} S^2 + \frac{1}{4} h^2$; & (propter $Omn . h^2, = \frac{1}{3} H^3$), simul omnia, seu totius $AVH\Delta$, momentum respectu $A\Delta$, $\frac{1}{2} S^2 H + \frac{1}{4} H^3$. Quod ex (totius $ADH\Delta$ momento) $\frac{1}{2} K^2 H = \frac{1}{2} S^2 H + \frac{1}{4} H^3$ subductum, relinquit residui HVD , respectu $A\Delta$, momentum $\frac{1}{4} H^3$.

Ergo (propter distantias momentis proportionales,) in DH , sumptâ DG , quæ sit ad AD , ut $\frac{1}{4} L D^2 + \frac{1}{6} D^3$ ad $\frac{1}{4} H^3$; hoc est, $3 T L^2 D^2 + 2 L^2 D^3$ ad $4 T^2 H^3$; erit in (junctâ) AG , ipsius HVD centrum Gravitatis ; utpote cujus puncta singula in eâ ratione distant ab AD , $A\Delta$.

Idem obtinebitur ope momenti ipsius HVD respectu Asymptotæ $A\sigma$.

Est (per § D Prop. 31. Cap. 5.) ipsius $OVHS$, respectu $A\sigma$, momentum ABO . Est autem Trianguli ASX ($= \frac{1}{2} A^2$), respectu ejusdem $A\sigma$, momentum $\frac{1}{3} A^3$; & Trianguli AOV momentum $\frac{1}{3} E^3$; positisque $HX (=A-B) = X$, & DB (parallelâ AS) $= Y$, adeoque $HDX = \frac{1}{2} XY$, hujusque ab $A\sigma$ distantia centri Gravitatis $A - \frac{1}{3} Y$, erit Trianguli HDX , respectu $A\sigma$, momentum $\frac{1}{2} AXY - \frac{1}{6} XY^2$. Ergo (propter $HVD = ASX - AOV - OVHS - HDX$) ipsius HVD , respectu $A\sigma$, momentum $\frac{1}{3} A^3 - \frac{1}{3} E^3 - ABO - \frac{1}{2} AXY + \frac{1}{6} XY^2$.

Ergo

Ergo (propter distantias momentis proportionales) in DH , sumpta DQ , quæ sit ad AS , ut $\frac{1}{4}LD^2 + \frac{L}{6T}D^3$ ad $\frac{1}{3}A^3 - \frac{1}{3}E^3 - ABO - \frac{1}{2}AXY + \frac{1}{6}XY^2$; ducta-
que QK parallelâ AX occurrente SX in K ; erit in (juncta) AK , (utpote
cujus singula puncta in ea ratione distant ab AD , $A\sigma$,) Centrum gravitatis
 HVD . Quæ quidem AK est eadem positione recta cum AG ; quoniam utraq;
tum per A transit, tum per Centrum Gravitatis HVD .

Similiter (ob eandem causam,) in ΔH sumpta ΔL , quæ sit ad AS , ut
 $\frac{T}{3L}H^3$ ad $\frac{1}{3}A^3 - \frac{1}{3}E^3 - ABO - \frac{1}{2}AXY + \frac{1}{6}XY^2$; ductaque LK parallelâ $A\Delta$,
occurrente SX in K ; erit in (juncta) AK (cujus utique singula puncta in ea
ratione distant ab $A\Delta$, $A\sigma$,) centrum gravitatis HVD . Erit autem hoc
 K idem quod prius, ob causam modò insinuatam.

12. Simili processu utendum in spatio exteriori $OVHS$.

Est enim (ut jam ostensum) hujus, respectu $A\sigma$, momentum ABO .

Item, respectu AX , Trianguli $ASX = \frac{1}{2}A^2$ est (propter centri ab AX
distantiam $\frac{1}{3}A\sqrt{\frac{1}{2}}$) momentum $\frac{1}{6}A^3\sqrt{\frac{1}{2}}$; & similiter, Trianguli AOV , mo-
mentum $\frac{1}{6}E^3\sqrt{\frac{1}{2}}$; Trianguli que $HDX = \frac{1}{2}XY$ (propter distantiam $\frac{1}{3}H$) mo-
mentum $\frac{1}{6}XYH$; ipsiusque HVD (ut modò) $\frac{1}{4}LD^2 + \frac{L}{6T}D^3$. Ergo (propter
 $OVHS = ASX - AOV - HDX - HVD$,) ipsius $OVHS$, respectu AX , mo-
mentum $\frac{1}{6}A^3\sqrt{\frac{1}{2}} - \frac{1}{6}E^3\sqrt{\frac{1}{2}} - \frac{1}{6}XYH - \frac{1}{4}LD^2 - \frac{L}{6T}D^3$.

Ergo (propter distantias momentis proportionales,) in DH , sumpta DI , quæ
sit, ad AS , ut $\frac{1}{6}A^3\sqrt{\frac{1}{2}} - \frac{1}{6}E^3\sqrt{\frac{1}{2}} - \frac{1}{6}XYH - \frac{1}{4}LD^2 - \frac{L}{6T}D^3$ ad ABO : ducta-
que IF parallelâ AX , occurrente SX in F ; erit in (juncta) AF (cujus
puncta singula in ea ratione distant ab AX , $A\sigma$,) centrum gravitatis $OVHS$.

Idem obtinebitur comparando ejusdem $OVHS$ momenta respectu $A\sigma$, & $A\Delta$;
vel AX , & $A\Delta$; eandem autem AF prodire necesse erit, ut quæ transire de-
beat tum per A , tum per ipsius $OVHS$ centrum gravitatis.

13. Simili item processu utendum est in spatio exteriori $AVH\Delta$.

Est enim (ut modò) hujus respectu $A\Delta$ momentum $\frac{1}{2}S^2H + \frac{T}{6L}H^3$.

Idem, respectu AX ; rectanguli $ADH\Delta$ momentum $\frac{1}{2}KH^2$; unde sub-
ducto ipsius HVD momento $\frac{1}{4}LD^2 + \frac{L}{6T}D^3$; habebitur ipsius $AVH\Delta$ respectu
 AX momentum $\frac{1}{2}KH^2 - \frac{1}{4}LD^2 - \frac{L}{6T}D^3$.

Ergo, in ΔH , sumpta ΔM , quæ sit ad DH , ut $\frac{1}{2}S^2H + \frac{T}{6L}H^3$ ad
 $\frac{1}{2}KH^2 - \frac{1}{4}LD^2 - \frac{L}{6T}D^3$; erit in (juncta) AM (cujus singula puncta in ea
ratione distant ab $A\Delta$, AX ,) centrum gravitatis $AVH\Delta$.

Idemque obtinebitur comparatis ejusdem momentis respectu $A\Delta$, & $A\sigma$;
vel respectu AX , & $A\sigma$: eandem autem AM prodire necesse erit, ob causam
ante insinuatam: Ut non sit spes inde, ob duas ejusmodi rectas, se mutuo
decussantes, ipsum centrum obtinendi, absque Plani magnitudine.

Si verò in his omnibus vel non sit $S A\sigma$ ang. rectus; vel Hyperbola, vel Sca-
lena (sumpta Diametro quavis aliâ loco Axis AX ;) similis adhibenda crit ac-
commodatio cum ea, quam de Scalenis insinnavimus ad $S K$ prop. 31. c. 5.
Dab. Oxon. Aug. 31. 1672.

An Accompt of some Books.

- I. *Traſſatus de NATURA SUBSTANTIÆ ENERGETICÆ, seu de VITA NATURÆ, ejuſq; Tribus primis Facultatibus; Perceptiva, Appetitiva, Motiva, &c. Auth. Franc. Gliffonio, Med. D, & P. & Coll. Med. Lond. Socio, nec non Societatis Regalis Collegæ. Londini. A. 1672. in 4°.*

THE famous Author of this Philosophical Treatiſe endeavors to make it out, that matter is the Prime and Radical ſubject of *Life*; or, that *Life* is the inmoſt eſſence of matter, and inſeparable from the ſame: And, becauſe the very Eſſence of matter is ſubject to various Modifications, that thence its life alſo is capable of being variously modified, ſo as to be different in Plants and Animals; being in all their kinds varied by a ſtrange diverſity of Structure and Organization.

This Life our Author eſteems to be the very Energetical nature of a ſubſtance, whereby it is fitted for Operation, that is, made a Principle of Perception, Appetition and Motion; not producible in his opinion by any external power, motion, texture, figure, organization, proportion, or connexion of parts, but by the ſole Firſt Cauſe of all things.

The ſame Life, as 'tis eſſential to matter, is here diſtinguiſh'd from the *Senſes*; which to our Author are not the very firſt and ſimple perception of Nature, but ſome Organical Modifications thereof; for aſmuch as, in his opinion, if there were no *Natural* perception, no modification or organization of matter would be able to change it into *Animal* or *Senſitive*; but a *Natural* one being given, this, flowing immediately from the ſubſtantial nature of the matter, will be ſubject to as many kinds of Modifications, as the matter it ſelf is capable of. And it ſeems, that the main ſcope of this book was, to inveſtigate thoſe various Modifications of life; though the Author ingeniouſly confeſſeth, to have met with ſuch difficulties in this argument, that as yet he hath not ſo much as gone through all the variations of *Inanimat* Subſtances; much leſs through thoſe very ſubtile Formations of *Plants* and *Animals*.

If it be aſked, How this *Natural* Perception becomes *Senſitive* or *Animal*; the Doctor answers, That diſpoſed matter, finding it ſelf capable, ſo far to raiſe its perceptions, as to redouble it, whereby it may be enabled to judge of its own acts and to behold them with delight, falls upon organizing,
and

and adapts for every Sense as 'twere a double Organ, an internal and external ; and the same matter perceiving withal, that 'tis needless, there should be an internal one, appropriate for every external, it forms one only internal, Common to all the external, and by proper nerves connects each external to it. And this to him constitutes *Sensation*, which he saith is not performed without *redoubling* the act of Perception ; since, if a Nerve, by whose means Perception is redoubled, be any way intercepted, as in a *Gutta serena*, or in a Paralitick Member, there is no Sensation. So that, according to our Author, Sensation is Perception enobled and exalted, able to judge of its object, to reflect upon it with complacency, to suspend its action, to avert it self from one object to another ; whence Brutes themselves are by him observ'd to be in some measure capable of Discipline, and of reward and punishment.

From all which it appears, that here is asserted such a Natural Perception, as is anterior to, more general, and more simple than that of *Sense* ; in which perception, accompanied with appetite and motion, our Author makes Original Life to consist, which to him is nothing else but the Energetical nature of any being subsisting by it self, since he understands not, that so noble a being as that is which subsists by it self, should be useless, and fit for no operation.

If any do object, that these general notions are too soon brought upon the Stage, and that *Particular* Forms are to be found out first, and thence we are to rise to the *Universal*, forasmuch as there is nothing in the Understanding which has not been first in the Sense ; our Author thinks this ratiocination to be grounded upon a false supposition, as if the particular reasons of things did incur into our senses before the universal.

There are too many things in this Treatise for such a Breviat as this must be, to take notice of them all. One particular there is, that seems very paradoxical ; which I shall but touch, and then conclude, it is, That this Author judgeth it to be more Philosophical, to hold a *Penetration of Substances* than a *Vacuum* ; and that a *Motion* not being to be denied, and consequently either a *Vacuum*, or such a *Penetration* to be asserted, the former of these being by him, as he thinks, disproved, the latter (*Penetration*) must take place.

II. *Jeremiæ Horroccii Angli Opera Posthuma: unâ cum Guil. Crabtræi Observationibus Cælestibus ; nec non Joh. Flamstedii de Temporis Equatione Diatriba, Numerisq; Lunaribus ad novum LUNÆ Systema Horroccii. Londini, impensis Joh. Martyn, R. Societatis Typographi, A. 1672. in 4°.*

THis *Horrox* is the same with him, that is the Author of that excellent Tract, called *Venus in Sole visa*, publish't by the famous *Johannes Hevelius* together with his *Mercurius in Sole visus*: who if he had not been snatch't away by an untimely death in the flower of his age, would certainly, by his industry and exactness, which did accompany his great affection to Astronomy, have very considerably advanced that Science. Now we have only left us these imperfect Papers, digested, not without great care and labour, by that Learned Mathematician Dr. *John Wallis* ; Wherein does occur,

First, the *Keplerian* Astronomy, asserted and promoted ; which this Author undertook, after he had spent much time, and taken great pains in acquainting himself with that of *Lansbergius*, which he at first embraced with so much eagerness and addition, that it was difficult to divorce him from it ; till at length, by the advertisements of *William Crabtree*, a sagacious and diligent Astronomer of that time, he found, that neither the *Hypotheses* of *Lansbergius* were consistent among themselves, nor his *Tables* agreed with Observations exactly made, nor the Precepts of them were well demonstrated or could be ; whatever that man boasted of the wonderfull agreement of his *Tables* with the Observations of former times : All which errors having been found at last by our Author himself, and withall the writings of *Kepler*, and the *Rudolphin Tables* by him search't into, he saw cause far to prefer them to the *Lansbergian*, because grounded upon *Hypotheses* consonant to Nature, and well agreeing with the Heavens : though he found cause by his accurate Observations to amend even these *Tables* ; yet without a necessity of changing the *Hypothesis*. In which work when he was well engaged, he was cut off by death very young, in the 23th year of his age. His first piece then, were his Disputations against the Astronomy of *Lansbergius*, in which he clearly demonstrates, that the *Hypotheses* of that Author do neither agree with the Heavens nor among themselves. Which argument he carried on so far, that having finish't the *four* first Dispu-

Disputations (as they are here to be found) he had begun a few sheets of the *fifth*, which was about the Diagram of *Hipparchus*, from which some have pretended exactly to demonstrate the Distance of the Sun. After which follow two Disputations more; the *one*, of the Celestial bodies and their Motion; the *other*, his Answer to the Cavils of *Hortensius* against *Tycho*. So much of the *First* part of this Volume.

The *second* contains a good number of *Extracts* out of this Authors Letters to his intimate friend and industrious companion in the Study of Astronomy, *William Crabtree*. In which occur many good Celestial Observations, interlaced with divers notable discourses concerning the Method of his studies.

The *third*, is a Catalogue of Astronomical Observations, as they were made by our Author, without allowance for the Eccentricity of the Eye; which he afterwards castigated by a correction fairly written with his own hand.

The *fourth*, is his New Theory of the Moon, together with the *Lunar Numbers* of Mr. *Flamsteed* upon it.

To these are annexed, *first* the Celestial Observations of *William Crabtree*, concerning *Saturn*, *Jupiter*, *Mars* and *Venus*; and then, Mr. *Flamsteeds* Dissertation of the *Inequality* of Solar days; wherein are demonstrated the *Prosthaphæreses* of the time, necessary to make an Equation, and proceeding from the Unequal motion of the Earth from the *Aphelion* to the *Perihelion*, and the Inclination from the *Equinoxes* to the *Solstices*, and *vice versa*.

III. Marcelli Malpighii Phil. & Medici Bononiensis Dissertatio Epistolica de Formatione Pulli in Ovo: Londini apud Joh. Martyn Soc. Reg. Typographum, ad insigne Campanæ in Cæmeterio S. Pauli, 1672. in 4^o.

THis excellent Philosopher and Accurate Anatomist, a very Industrious and useful Member of the *R. Society*, having in a *Manuscript* presented that Illustrious body with his Observations upon the Formation of a Chick in an Egg as well before as after Incubation; and that Company having esteemed them very worthy the Press, as well to do the Author right, as to give occasion to others to inquire further into a matter so conducive for finding out the nature of Generation: We shall here give some accompt of this well-consider'd discourse; after we have intimated, that an English Physitian, a worthy Membe.

Member also of the said Society, (Dr. *William Croon*,) hath likewise, by a curious examination of Eggs not yet incubated, very happily found, in conformity to the discovery of Signor *Malpighi*, the Rudiments of a Chick actually existent in the Egg even *before* incubation: Of which he produced a written discourse before the said Society *March* 14. 1671; which he affirmed to have been written a good while before, and which was read in part *March* 28. 1672. at the publick Meeting of the said Society: who do hope, that the said *Doctor* will make no difficulty, for confirmation and further excitement, to communicate also to the publick his learned Observations upon this subject. Which being thus premis'd, we shall now proceed briefly to take notice, that this Exercitation of Signor *Malpighi*, which came to the *R. Society*, *Feb.* 22. 1672¹/₂, contains an account of his having, by carefull and diligent Observations, discover'd, that in *second* Eggs, as well *before* as *after* incubation, the first Rudiments and Lines of the principal parts of the Chick are contained in the Eggs; whereas in *Subventaneous* or *Adle* Eggs, instead of such a formation, there is found nothing but an un-form'd globous ash-coloured body, like a *mola*. Of these *prima stamina* or beginnings, this Author hath traced the progress, by observing their changes, after incubation, every six hours, for the two first days; and, after that, every 12 or 24, or 48 hours. In the doing of which, he hath observ'd many very curious and remarkable particulars, especially about the Priority of the Motion of the Heart *before* the production of true blood, though that liquor, before it becomes red, be, according to him, *before* the motion of the heart; as also about the said liquor first emerging, *viz.* whether it be a simple *colliquamentum*, or a *liquor vitalis*, or a *sanguis inchoatus*: concerning which he asserts, that the *Carina*, and the beginnings of the head, brain, and Spinal Marrow, do manifestly appear *before* the Collection of that Liquor, and its motion, and change into the nature of Blood: For which, and many other considerable particulars, since they cannot be treated in such an abstract as this without prejudicing the whole, we are obliged to remit the Reader to the intire discourse it self.

IV. De MENTE HUMANA Libri quatuor &c. Auth. J. B. du Hamel
P. S. L. Parisiis A. 1672. in 12.

THE Learned Author of this Book treats in it of the Nature, Powers, Functions, and Immortality of the soul; delivering withal a solid Logick, illustrated by various and instructive experiments. This he doth in *four* parts;

In the *first* he inquireth into the nature, origine and progress of knowledge in general, and of *simple Perception* in particular; observing the chief defects of perceptions, together with their remedies, Attention, and Consideration, much helped by the study of the Mathematicks, and by Reces, &c.

In the *second* he treats, after the same method, of the Judgment of the Mind, the height and perfection of humane knowledge. Where he discourses largely of the *Criterion* and Mark of Truth, consisting principally in the clearness and distinctness of Perception, as that, whereby the mind *knows* the congruity of its knowledge with the thing known. Here he taketh occasion to examine *Pyrrhonisme* or *Scepticisme*, professed by a Sect of men that speak otherwise than they think. Which done, he endeavours to shew not only, whence the Light and Evidence of Principles flows, namely from Eternal and Immutable Reasons and *Idea's*, forming and directing our knowledge, and begetting a certain and firm judgment in us; but also, how we shall come to see those Eternal reasons or that Intrinsic Light of Truth. To all which he annexeth those Propositions, that are, in his judgment, to be esteemed for Principles and Axioms so evident, that their Truth shineth forth by themselves, and needs no demonstration: Concluding this part with a considerable Enumeration *both* of the principal Causes of Errors, (which may be resolv'd into that main one, the *Confusion of Perceptions*, breeding either a hasty and un-advised, or a false judgment,) and of the Remedies of the same.

In the *Third*, he treats of *Argumentation* and its nature and origine; of Syllogismes and Paralogismes; and especially of the true way of Demonstrating; which latter he so performs, that little seems to be by him omitted of what hath been written by others that is considerable. And least a naked and jejune delivery of Rules should prove tedious to the Reader, he hath made them grateful with abundance of uncommon and pleasing examples; and laboured, not only in a Logical but *Physiological* way to explain the cause, nature, windings and errors of Ratiocination. Besides, his purpose being to deliver a *Logick*, futable not only to the old Scholastick, but also to the Modern and Experimental Philosophy; he discourseth copiously and instructively of *Induction*; shewing from the Excellent Lord of *Verulam*, and the Illustrious *Robert Boyle*, how Natural Philosophy and all useful Arts may be improv'd and advanced by the hitherto too much

much neglected induction. Where he takes occasion to speak of and commend that way of finding out the *Efficient* causes of things, call'd by the newly mention'd Lord *Instantia Crucis*, because, like a Cross erected where more ways than one do meet, it shews which of them you are to take. Which, among others, he illustrates by the example concerning the Question of the *Cause of Gravity*. viz. Whether it be a Quality inherent in bodies, or the Magnetical power of the Earth, or the Circum-ambient Air or *Æther*? Alledging for this purpose an Experiment, seeming to him to be such a determining instance as hath been spoken of; made by Monsieur *Hugens* before the Royal Academy at *Paris*, and related at large by Monsr. *Rohault* in his *Traite de Physique*, printed at *Paris* A. 1671. part 2. ch. 28. p. 122. to which we refer the Reader; hastning to

The Fourth and last part of this Book, which considers the Powers, Nature, and Immortality of the Rational Soul, and is solicitously employ'd in solving many difficulties occurring about this matter: Which being a subject not so proper to the design of these Tracts, we shall here forbear to enlarge upon.

V. A Letter of *Francesco Redi* concerning some Objections made upon his Observations about *Vipers*; together with a Reply to that Letter by *Moyse Charas*: Now both Printed in *English*, for *John Martyn*. Printer to the R. Society, at the Bell in *St. Pauls Church yard*, 1672. in 8^o; and formerly described in these Tracts, viz. Numb. 66. p. 2036. and Numb. 83. p. 4073.

VI. *De Gemmarum Origine. & Viribus Exercitatio*: Auth. *Roberto Boyle*, Nobili Anglo. This Tract was also formerly, when it first came abroad in *English*, described, viz. in Numb. 84. p. 4095. and is now mention'd again, only to give notice to Forrainers, that 'tis printed in *Latin* for the same Bookseller, for whom was printed the *English* Edition.

Errata in this Tract.

Pag. 5053. l. 19. r. in its pristine. p. 5055. l. 26. r. vehicle.

LONDON,

Printed for John Martyn, Printer to the Royal Society, 1672.

PHILOSOPHICAL TRANSACTIONS.

November 18. 1672.

The CONTENTS.

Mr. Isaac Newtons Answer to some Considerations upon his Doctrine of Light and Colors, as it was Printed in Numb. 80. of these Tracts: In which Answer some things being premised about both the Practique and Theorique part of Opticks; the Author endeavours to make it out, that he assumes no Hypothesis for his Doctrine; that the Examiners and all other Mechanical Hypotheses in their genuine constitution are conformable to his Doctrine; and that it is not necessary to limit or explain his Doctrine by any Hypothesis. To which is added a Resolution of three important Quære's, 1. Whether the Unequal Refractions, made without respect to any inequality of incidence, be caused by the different Refrangibility of several rays; or by the Splitting, Breaking or Dissipating the same Ray into diverging parts? 2. Whether there be more than two Original colours? 3. Whether Whiteness be a mixture of all Colors? Some particulars of this subject recommended to further Consideration. An Accompt of two Books: I. Oibonis de Gericke EXPERIMENTA MAGDEBURGICA NOVA, II. Thesaurus MEDICINÆ PRACTICÆ, Studio & operâ Thomæ Burnet. M D. &c.

K k k k k

Mr;

Mr. Isaac Newtons *Answer to some Considerations upon his Doctrine of Light and Colors*; which *Doctrine* was printed in Numb. 80. of these *Tracts*.

SIR, I have already told you, that at the perusal of the *Considerations*, you sent me, on my Letter concerning *Refractions* and *Colors*, I found nothing, that, as I conceived, might not without difficulty be answer'd. And though I find the *Considerer* somewhat more concern'd for an *Hypothesis*, than I expected; yet I doubt not, but we have one common design; I mean, a sincere endeavour after knowledge, without valuing uncertain speculations for their subtleties, or despising certainties for their plainness: And on confidence of this it is, that I make this return to his discourse.*

* Which Discourse was thought needless to be here printed at length, because in the body of this Answer are to be met with the chief particulars, wherein the Answerer was concern'd.

I. Of the *Practique* part of *Optiques*.

have acquainted him with my successes on the Tryals I have made of that kind, which I shall now say have been less than I sometimes expected, and perhaps than he at present hopes for. But since he is pleased to take it for granted, that I have let this subject pass without due examination, I shall refer him

* Printed in Numb. 80. of these *Tracts*.

to my former Letter, * by which that conjecture will appear to be un-grounded. For, what I said there, was in respect of Telescopes of the ordinary construction, signifying, that their improvement is not to be expected from the *well-figuring* of Glasses, as Opticians have imagin'd; but I despaired not of their improvement by other constructions; which made me cautious to insert nothing that might intimate the contrary. For, although successive refractions that are all made the same way, do necessarily more and more augment the errors of the first refraction; yet it seem'd not impossible for *contrary* refractions so to correct each others inequalities, as to make their difference regular; and, if that could

The first thing that offers it self is less agreeable to me, and I begin with it because it is so. The considerer is pleased to reprehend me for laying aside the thoughts of improving *Optiques* by *Refractions*.

If he had obliged me by a private Letter on this occasion, I would

could be conveniently effected, there would be no further difficulty. Now to this end I examin'd, what may be done not only by *Glasses alone*, but more especially by a Complication of divers successive *Mediums*, as by two or more Glasses or Crystals with Water or some other fluid between them; all which together may perform the office of *one Glass*, especially of the *Object-glass*, on whose construction the perfection of the instrument chiefly depends. But what the results in Theory or by Tryals have been, I may possibly find a more proper occasion to declare.

To the Assertion, that Rays are less true *reflected* to a point by a *Concave*, than *refracted* by a *Convex*, I cannot assent; nor do I understand, that the *focus* of the latter is less a line than that of the former. The truth of the contrary you will rather perceive by this following Table, computed for such a *Reflecting Concave*, and *Refracting convex*, on supposition that they have equal Apertures, and collect parallel rays at an equal distance from their *vertex*; which distance being divided into 15000 parts, the Diameter of the Concave Sphere will be 60000 of those parts, and of the Convex, 10000; supposing the *Sines* of Incidence and Refraction to be, in round numbers, as 2 to 3. And this Table shews, how much the exterior rays, at several Apertures, fall short of their principal *focus*.

The Diameter of the Aperture.	The parts of the Axis intercepted between the vertex and the rays.		The Error by	
	Reflected.	Refracted.	Reflexion.	Refraction.
2000	14991 $\frac{2}{3}$	14865	8 $\frac{1}{3}$	135 .
4000	14966	14449	33	551 .
6000	14924	13699	76	1301 .
8000	14865	12475	135	2525 .
10000	14787	9472	213	5528 .

By this you may perceive, that the Errors of the *Refracting convex* are so far from being *less*, that they are more than sixteen times greater than the like errors of the *Reflecting Concave*, especially in great Apertures; and that without respect to the Heterogeneous constitution of light. So that, however the contrary supposition might make the Author of these Animadversions reject *Reflections* as useless for the promoting of Op-

tiques ; yet I must for this as well as other considerations prefer them in the Theory before *Refractions*.

Whether the *Parabola* be more difficult to describe than the *Hyperbola* or *Ellipsis*, may be a *Quare* : But I see no absolute necessity of endeavouring after any of their descriptions. For, if Metals can be ground truly Spherical, they will bear as great Apertures, as I believe men will be well able to communicate an *exact* polish to. And for Dioptrique Telescopes, I told you, that the difficulty consisted not in the Figure of the glass, but in the Difformity of Refractions : Which if it did not, I could tell you a better and more easie remedy than the use of the *Conic Sections*.

2. Of the Theorique part.

Thus much concerning the *Practique* part of Optiques. I shall now take a view of the Considerations on my *Theories*. And those consist in ascribing an *Hypothesis* to me, which is not mine; in Asserting an *Hypothesis*, which, as to the principal parts, is not against me ; in Granting the greatest part of my discourse if explicated by that *Hypothesis* ; and in Denying some things, the truth of which would have appear'd by an experimental examination.

3. Of an Hypothesis mistaken to be mine.

Of these Particulars I shall discourse in order. And first of the *Hypothesis*, which is ascribed to me in these words : *But grant his first supposition, that light is a body, and that as many colours or degrees as there may be, so many bodies there may be ; all which compounded together would make White, &c.* This, it seems, is taken for my *Hypothesis*. 'Tis true, that from my Theory I argue the *Corporeity* of Light ; but I do it without any absolute positiveness, as the word *perhaps* intimates ; and make it at most but a very plausible consequence of the Doctrine, and not a fundamental *Supposition*, nor so much as any part of it ; which was wholly comprehended in the precedent Propositions. And I somewhat wonder, how the *Objector* could imagine, that, when I had asserted the Theory with the greatest rigour, I should be so forgetful as afterwards to assert the fundamental supposition it self with no more than a *perhaps*. Had I intended any such *Hypothesis*, I should somewhere have explain'd it. But I knew, that the *Properties*, which I declar'd of *Light*, were in some

some measure capable of being explicated not only by that, but by many other Mechanical *Hypotheses*. And therefore I chose to decline them all, and to speak of *Light* in general terms, considering it abstractly, as something or other propagated every way in streight lines from luminous bodies, without determining, what that Thing is; whether a confused Mixture of difform qualities, or Modes of bodies, or of Bodies themselves, or of any Virtues, Powers, or Beings whatsoever. And for the same reason I chose to speak of *Colours* according to the information of our Senses, as if they were Qualities of Light *without* us. Whereas by that *Hypothesis* I must have considered them rather as *Modes* of Sensation, excited in the mind by various motions, figures, or sizes of the corpuscles of Light, making various Mechanical impressions on the Organ of Sense; as I expressed it in that place, where I spake of the Corporeity of Light.

But supposing I had propounded that *Hypothesis*, I understand not, why the Objector should so much endeavour to oppose it. For certainly it has a much greater affinity with his own *Hypothesis*, than he seems to be aware of; the Vibrations of the *Æther* being as useful and necessary in *this*, as in *his*. For, assuming the Rays of Light to be small bodies, emitted every way from Shining substances, those, when they impinge on any Refracting or Reflecting superficies, must as necessarily excite Vibrations in the *æther*, as Stones do in water when thrown into it. And supposing these Vibrations to be of several depths or thickneses, accordingly as they are excited by the said corpuscular rays of various sizes and velocities; of what use they will be for explicating the manner of Reflection and Refraction, the production of Heat by the Sun-beams, the Emission of Light from burning putrifying, or other substances, whose parts are vehemently agitated, the *Phænomena* of thin transparent Plates and Bubbles, and of all Natural bodies, the Manner of Vision, and the Difference of Colors, as also their Harmony and Discord; I shall leave to their consideration, who may think it worth their endeavor to apply this *Hypothesis* to the solution of *phænomena*.

In the second place, I told you, that the Objectors Hypothesis, as to the fundamental part of it, is not against me. That fundamental Supposition is: *That the parts of bodies, when briskly agitated, do excite Vibrations in the Æther, which are propagated every way from those bodies in streight lines, and cause a Sensation of Light by beating and dashing against the bottom of the Eye, something after the manner that Vibrations in the Air cause a Sensation of Sound by beating against the Organs of Hearing.* Now, the most free and natural Application of this Hypothesis to the Solution of *phenomena* I take to be this: *That the agitated parts of bodies, according to their several sizes, figures, and motions, do excite Vibrations in the æther of various depths or bignesses, which being promiscuously propagated through that Medium to our Eyes, effect in us a Sensation of Light of a White colour; but if by any means those of unequal bignesses be separated from one another, the largest beget a Sensation of a Red colour, the least or shortest, of a deep Violet, and the intermediat ones, of intermediat colors; much after the manner that bodies, according to their several sizes, shapes, and motions, excite vibrations in the Air of various bignesses, which, according to those bignesses, make several Tones in Sound: That the largest Vibrations are best able to overcome the resistance of a Refracting superficies, and so break through it with least Refraction; whence the Vibrations of several bignesses, that is, the Rays of several Colors, which are blended together in Light, must be parted from one another by Refraction, and so cause the Phenomena of Prisms and other refracting substances: And that it depends on the thickness of a thin transparent Plate or Buble, whether a Vibration shall be reflected at its further superficies, or transmitted; so that, according to the number of vibrations, interceding the two superficies, they may be reflected or transmitted for many successive thicknesses. And since the Vibrations which make Blue and Violet, are supposed shorter than those which make Red and Yellow, they must be reflected at a less thickness of the Plate: Which is sufficient to explicate all the ordinary phenomena of those Plates or Bubbles, and also of all natural bodies,*

4. *Of the Objector's Hypothesis, and that the most free and genuine Constitution of that and all other Mechanical Hypotheses is conformable to my Doctrine.*

whole

whose parts are like so many fragments of such Plates.

These seem to be the most plain, genuine and necessary conditions of this *Hypothesis*: And they agree so justly with my Theory, that if the *Animadversor* think fit to apply them, he need not, on that account, apprehend a divorce from it. But yet how he will defend it from other difficulties, I know not. For, to me, the Fundamental Supposition it self seems impossible; namely, That the *Waves* or Vibrations of any Fluid, can, like the Rays of Light, be propagated in *Streight* lines, without a continual and very extravagant spreading and bending every way into the quiescent Medium, where they are terminated by it. I mistake, if there be not both Experiment and Demonstration to the contrary. And as to the other two or three *Hypotheses*, which he mentions, I had rather believe them subject to the like difficulties, than suspect the *Animadversor* should select the worst for his own.

What I have said of this, may be easily applied to all other *Mechanical Hypotheses*, in which Light is supposed to be caused by any Pression or Motion whatsoever, excited in the *æther* by the agitated parts of Luminous bodies. For, it seems impossible, that any of those Motions or Pressions can be propagated in *streight* lines without the like spreading every way into the shadow'd Medium, on which they border. But yet, if any man can think it possible, he must at least allow, that those Motions or Endeavors to motion, caused in the *æther* by the several parts of any Lucid body that differ in size, figure, and agitation, must necessarily be unequal: Which is enough to denominate Light an Aggregat of *difform* rays, according to any of those Hypotheses. And if those Original inequalities may suffice to difference the Rays in Colour and Refrangibility, I see no reason, why they, that adhere to any of those *hypotheses*, should seek for other Causes of these Effects, unless (to use the *Objectors* argument) they will multiply entities without necessity.

The *third* thing to be considered is, the Condition of the *Animadversor's* Concessions, which is, that I would explicate my *Theories* by his *Hypothesis*: And if I could comply with him in that point,

§. Of the Animadversor's Concessions, and their limitation to his Hypothesis.

there

there would be little or no difference between Us. For he grants, that without any respect to a different Incidence of rays there are different Refractions; but he would have it explicated, not by the different Refrangibility of several Rays, but by the Splitting and Rarefying of æthereal pulses. He grants my *third, fourth and sixth* Propositions; the sense of which is, That Un-compounded Colors are unchangeable, and that Compounded ones are changeable only by resolving them into the colors, of which they are compounded; and that all the Changes, which can be wrought in Colours, are effected only by variously mixing or parting them: But he grants them on condition that I will explicate Colors by the two sides of a split pulse, and so make but two *species* of them, accounting all other Colors in the world to be but various degrees and dilutings of those two. And he further grants, that *Whitenesse* is produced by the Convention of all Colors; but then I must allow it to be not only by Mixture of those Colors, but by a farther Uniting of the parts of the Ray supposed to be formerly split.

If I would proceed to examine these his Explications, I think it would be no difficult matter to shew, that they are not only *insufficient*, but in some respects to me (at least) *un-intelligible*. For, though it be easie to conceive, how Motion may be dilated and spread, or how parallel motions may become diverging; yet I understand not, by what artifice any *Linear* motion can by a refracting superficies be *infinitely* dilated and rarefied, so as to become *Superficial*: Or, if that be supposed, yet I understand as little, why it should be split at so small an angle only, and not rather spread and dispersed through the whole angle of Refraction. And further, though I can easily imagine, how Unlike motions may cross one another; yet I cannot well conceive, how they should coalesce into one *uniform* motion, and then part again, and recover their former Unlikeness; notwithstanding that I conjecture the ways, by which the *Animadversor* may endeavour to explain it. So that the Direct, uniform and undisturbed Pulses should be split and disturbed by Refraction; and yet the Oblique and disturbed Pulses persist without splitting or further disturbance by following Refractions, is (to me) as unintelligible. And there is

as great a difficulty in the Number of Colours; as you will see hereafter.

But whatever be the advantages or disadvantages of this *Hypothesis*, I hope I may be excused from taking it up, since I do not think it

6. That it is not necessary, to limit or explain my Doctrine by any Hypothesis.

needful to explicate my Doctrine by any *Hypothesis* at all. For if *Light* be consider'd abstractedly without respect to any *Hypothesis*, I can as easily conceive, that the several parts of a shining body may emit rays of differing colours and other qualities, of all which *Light* is constituted, as that the several parts of a false or uneven string, or of uneavenly agitated water in a Brook or Cataract, or the several Pipes of an Organ inspired all at once, or all the variety of Sounding bodies in the world together, should produce sounds of several Tones, and propagate them through the Air confusedly intermixt. And, if there were any natural bodies that could reflect sounds of one tone, and stifle or transmit those of another; then, as the *Echo* of a confused Aggregat of all Tones would be that particular Tone, which the Echoing body is disposed to reflect; so, since (even by the *Animadversor's* concessions) there are bodies apt to reflect rays of one colour, and stifle or transmit those of another; I can as easily conceive, that those bodies, when illuminated by a mixture of all colours, must appear of that colour only which they reflect.

But when the *Objector* would insinuate a difficulty in these things, by alluding to Sounds in the string of a Musical instrument before percussion, or in the Air of an Organ Bellows before its arrival at the Pipes; I must confess, I understand it as little, as if one had spoken of *Light* in a piece of Wood before it be set on fire, or in the oyl of a Lamp before it ascend up the match to feed the flame.

You see therefore, how much it is besides the business in hand, to dispute about *Hypotheses*. For which reason I shall now in the last place, proceed to abstract the

7. The difficulties of the *Animadversors* discourse abstracted from Hypotheses, and consider'd more generally.

difficulties in the *Animadversor's* discourse, and, without having regard to any *Hypothesis*, consider them in general terms. And they may be reduced to these 3 *Queres*: L l l l l 1. Whe-

1. Whether the unequal Refractions, made without respect to any inequality of incidence, be caused by the different Refrangibility of several Rays; or by the splitting, breaking or dissipating the same Ray into diverging parts?

2. Whether there be more than two sorts of Colours?

3. Whether Whiteness be a mixture of all Colours?

8. That the Ray is not split, or any otherwise dilated.

The *First* of these *Quæres* you may find already determin'd by an Experiment in my former Letter;

the design of which was to shew, That the length of the colour'd Image proceeded not from any unevenness in the Glass, or any other *contingent* Irregularity in the Refractions. Amongst other Irregularities I know not, what is more obvious to suspect, than a fortuitous dilating and spreading of Light after some such manner, as *Des-Cartes* hath described in his *Æthereal* Refractions for explicating the *Tayle* of a *Comet*; or as the *Animadversor* now supposes to be effected by the Splitting and Rarifying of his *Æthereal* pulses. And to prevent the suspicion of any such Irregularities, I told you, that I refracted the Light contrary ways with two Prisms successively, to destroy thereby the *Regular* effects of the *first* Prism by the *second*, and to discover the *Irregular* effects by augmenting them with iterated refractions. Now, amongst other Irregularities, if the *first* Prism had spread and dissipated every ray into an indefinit number of diverging parts, the *second* should in like manner have spread and dissipated every one of those parts into a further indefinite number, whereby the Image would have been still more dilated, contrary to the event. And this ought to have hapned, because those Linear diverging parts depend not on one another for the manner of their Refraction, but are every one of them as truly and completely Rays as the whole was before its Incidence; as may appear by intercepting them severally.

The reasonableness of this proceeding will perhaps better appear by acquainting you with this further circumstance. I sometimes placed the *second* Prism in a position Transverse to the *first*, on design to try, if it would make the long Image become four-square by refractions crossing those that had drawn the round Image into a long one. For, if amongst other Irregularities the Refraction of the *first* Prism, did by Splitting dilate

dilate a Linear ray into a Superficial, the Cross refractions of that *second* Prisme ought by further splitting to dilate and draw that Superficial ray into a Pyramidal solid. But, upon tryal, I found it otherwise; the Image being as regularly Ob- long as before, and inclin'd to both the Prismes at an angle of 45. degrees.

I tryed also all other Positions of the second Prisme, by turning the Ends about its middle part; and in no case could observe any such Irregularity. The Image was ever alike inclin'd to both Prismes, its Breadth answering to the Suns Diameter, and its length being greater or less accordingly as the Refractions more or less agreed, or contradicted one another.

And by these Observations, since the Breadth of the Image was not augmented by the Cross refraction of the *second* Prisme, that refraction must have been perform'd *without* any splitting or dilating of the ray; and therefore at least the Light incident on that Prisme must be granted an Aggregat of Rays *unequally refrangible* in my sense. And since the Image was equally inclin'd to both Prismes, and consequently the Refractions alike in both, it argues, that they were perform'd according to some *Constant Law* without any irregularity.

To determine the *second* Quæ- re, the *Animadversor* refers to an Experiment made with two

9. That there are more than two Original Colors.

Wedge-like boxes, recited in the *Micrography* of the Ingenious Mr. Hook Observ. 10. pag. 73. the design of which was to produce *all* Colours out of a mixture of *two*. But there is, I conceive, a double defect in this instance. For, it appears not, that by this Experiment all colours can be produced out of two; and, if they could, yet the Inference would not follow.

That *all* Colours cannot by that Experiment be produced out of two, will appear by considering, that the Tincture of *Aloes*, which afforded one of those Colours, was not all over of one uniform colour, but appear'd *yellow* near the edge of the Box, and *red* at other places where it was thicker: affording all variety of colours from a *pale yellow* to a *deep red* or *Scarlet*, according to the various thickness of the liquor. And so the

Solution of *Copper*, which afforded the other colour, was of various *Blews* and *Indigo's*. So that instead of *two* colours, here is a great variety made use of for the production of all others. Thus, for instance, to produce all sorts of *Greens*, the several degrees of *Yellow* and *pale Blew* must be mixed; but to compound *Purples*, the *Scarlet* and *deep Blew* are to be the Ingredients.

Now, if the *Animadversor* contend, that all the *Reds* and *Yellows* of the one Liquor, or *Blews* and *Indigo's* of the other, are only various degrees and dilutings of the same Colour, and not divers colours, that is a Begging of the Question: And I should as soon grant, that the two *Thirds* or *Sixths* in Musick are but several degrees of the same sound, and not divers sounds. Certainly it is much better to believe our Senses, informing us, that *Red* and *yellow* are divers colours, and to make it a Philosophical *Quære*, Why the same Liquor doth, according to its various thickness, appear of those divers colours, than to suppose them to be the same colour because exhibited by the same liquor? For, if that were a sufficient reason, then *Blew* and *Yellow* must also be the same colour, since they are both exhibited by the same Tincture of *Nepbritick Wood*. But that they are *divers* colours, you will more fully understand by the reason, which, in my Judgment, is this: The Tincture of *Aloes* is qualified to transmit *most easily* the rays indued with *red*, *most difficultly* the rays indued with *violet*, and with *intermediat degrees of facility* the rays indued with *intermediat* colours. So that where the liquor is very thin, it may suffice to intercept most of the *violet*, and yet transmit most of the other colours; all which together must compound a middle Colour, that is, a *faint yellow*. And where it is so much thicker as also to intercept most of the *Blew* and *Green*, the remaining *Green*, *Yellow*, and *Red*, it must compound an *Orenge*. And where the thickness is so great, that scarce any rays can pass through it besides those indued with *Red*, must appear of that colour, and that so much the deeper and obscurer, by how the liquor is thicker. And the same may be understood of the various degrees of *Blew*, exhibited by the Solution of *Copper*, by reason of its disposition to intercept *Red* most easily, and transmit a *deep Blew* or *Indigo* Colour most freely.

But, supposing that *all* Colours might, according to this experiment, be produced out of *two* by mixture; yet it follow^s not, that those two are the only *Original* colours, and that fo^r a double reason. *First*, because those two are not themself^s *Original* colours, but compounded of others; there being no liquor nor any other body in nature, whose colour in Day-light is wholly un-compounded. And *then*, because, though those two were *Original*, and all others might be compounded of them, yet it follows not, that they cannot be otherwise produced. For I said, that they had a double Origin, the same Colours to sense being in some cases compounded and in others un-compounded; and sufficiently declar'd in my *third* and *fourth* Propositions, and in the Conclusion, by what Properties the one might be known and distinguish'd from the other. But, because I suspect by some Circumstances, that the *Distinction* might not be rightly apprehended, I shall once more declare it, and further explain it by Examples.

That Colour is *Primary* or *Original*, which cannot by any Art be changed, and whose Rays are not *alike* refrangible: And that *Compounded*, which is changeable into other colours, and whose Rays are not *alike* refrangible. For instance, to know, whether the colour of any *Green* object be compounded or not, view it through a *Prisme*, and if it appear *confused*, and the edges tinged with *Blew*, *Yellow*, or any variety of other colours, then is that *Green* compounded of such colours as at its edges emerge out of it: But if it appear *distinct*, and well defin'd, and entirely *Green* to the very edges, without any other colours emerging, it is of an *Original* and un-compounded *Green*. In like manner, if a refracted beam of light, being cast on a white wall, exhibit a *Green* colour, to know whether that be compounded, refract the beam with an interposed *Prisme*; and if you find any *Difformity* in the refractions, and the *Green* be transform'd into *Blew*, *Yellow*, or any variety of other colours, you may conclude, that it was compounded of those which emerge: But if the Refractions be uniform, and the *Green* persist without any change of colour, then is it *Original* and un-compounded. And the reason why I call it so, is, because a *Green* indued with such properties cannot be produced by any mixing of other colours.

Now

Now, if two *Green* Objects may to the naked eye appear of the same colour, and yet one of them through a *prisme* seem *confused* and variegated with other colours at the edges, and the other *distinct* and entirely *Green*; or, if there may be two Beams of Light, which falling on a white wall do to the naked eye exhibit the same *Green* colour, and yet one of them, when transmitted through a *Prisme*, be uniformly and *regularly* refracted, and retain its colour unchanged, and the other be *irregularly* refracted and to divaricate into a multitude of other colours; I suppose, these two *greens* will in both cases be granted of a different Origin and constitution. And if by mixing colours, a *green* cannot be compounded with the properties of the *Unchangeable Green*, I think, I may call that an *Un-compounded* colour, especially since its rays are alike refrangible, and uniform in all respects.

The same rule is to be observ'd in examining, whether *Red*, *Orenge*, *Yellow*, *Blew*, or any other colour be compounded or not. And, by the way, since all *White* objects through the *Prisme* appear *confus'd* and terminated with colours, *Whiteness* must, according to this distinction, be ever compounded, and that the most of all colours, because it is the most *confus'd* and changed by *Refractions*.

From hence I may take occasion to communicate a way for the improvement of *Microscopes* by *Refraction*. The way is, by illuminating the Object in a darkned room with Light of any convenient colour not too much compounded: for by that means the *Microscope* will with *distinctness* bear a deeper Charge and larger Aperture, especially if its construction be such, as I may hereafter describe; for, the advantage in Ordinary *Microscopes* will not be so sensible.

10. That *Whiteness* is a mixture of all Colours.

There remains now the *third* Quære to be consider'd, which is, Whether *Whiteness* be an Uniform Colour, or a dissimilar Mixture of all colours? The Experiment which I brought to decide it, the *Animadversor* thinks may be otherwise explain'd, and so concludes nothing. But he might easily have satisfied himself by trying, what would be the result of a Mixture of all colours. And that very Experiment might have satisfied him, if he had pleased to examine it by the

the various circumstances. One circumstance I there declared, of which I see no notice taken; and it is, That if any colour at the *Lens* be intercepted, the *Whiteness* will be changed into the other colours: If all the colours but *red* be intercepted, that *Red* alone in the concourse or crossing of the Rays will not constitute *Whiteness*, but continues as much *Red* as before; and so of the other colours. So that the business is not only to shew, how rays, which before the concourse exhibit colours, do in the concourse exhibit *White*; but to shew, How in the same place, where the several sorts of rays apart exhibit several colours, a Confusion of all together make *White*. For instance, if red alone be first transmitted to the paper at the place of concourse, and then the other colours be let fall on that *Red*, the *Question* will be, Whether they convert it into *White*, by mixing with it only, as *Blew* falling on *Yellow* light is suppos'd to compound *Green*; or, Whether there be some further change wrought in the colours by their mutual acting on one another, untill, like contrary *Peripatetic* qualities, they become assimilated. And he that shall explicate this last Case *mechanically*, must conquer a double impossibility. He must *first* shew, that many unlike motions in a Fluid can by clashing so act on one another, and change each other, as to become one Uniform motion; and *then*, that an Uniform motion can of itself, without any new unequal impressions, depart into a great variety of motions regularly unequal. And after this he must further tell me, Why all Objects appear not of the same colour, that is, why their colours in the Air, where the rays that convey them every way are confusedly mixt, do not assimilate one another and become Uniform before they arrive at the Spectators eye?

But if there be yet any doubting, 'tis better to put the Event on further Circumstances of the *Experiment*, than to acquiesce in the possibility of any *Hypothetical* Explication. As, for instance, by trying, What will be the apparition of these colours in a very quick Consecution of one another. And this may be easily perform'd by the rapid gyration of a Wheel with many Spokes or coggs in its perimeter, whose Interstices and thickneses may be equal and of such a largeness, that, if the Wheel be interposed between the *Prisme* and the white concourse

of the colours, one half of the Colours may be intercepted by a spoake or cogg, and the other half pass through an interstice. The Wheel being in this posture, you may first turn it slowly about, to see all the colours fall successively on the same place of the paper, held at their aforesaid concourse; and if you then accelerate its gyration, until the Consecution of those colours be so quick, that you cannot distinguish them severally, the resulting colour will be a Whiteness perfectly like that, which an un-refracted beam of Light exhibits, when in like manner successively interrupted by the spoaks or coggs of that circulating Wheel. And that this *Whiteness* is produced by a successive Intermixture of the Colours, without their being assimilated, or reduc'd to any Uniformity, is certainly beyond all doubt, unless things that exist not at the same time may notwithstanding act on one another.

There are yet other Circumstances, by which the Truth might have been decided; as by viewing the White concourse of the Colours through another *Prisme* plac'd close to the eye, by whose Refraction that whiteness may appear again transform'd into Colours: And then, to examine their Origin, if an Assistant intercept any of the colours at the *Lens* before their arrival at the Whiteness, the same colours will vanish from amongst those, into which that Whiteness is converted by the *second Prisme*. Now, if the rays which disappear be the same with those that are intercepted, then it must be acknowledged, that the *second Prisme* makes no new colours in any rays, which were not in them *before* their concourse at the paper. Which is a plain indication, that the rays of several colours remain distinct from one another in the Whiteness, and that from their *previous* dispositions are deriv'd the Colours of the *second Prisme*. And, by the way, what is said of their Colors may be applied to their Refrangibility.

The aforesaid *Wheel* may be also here made use of; and, if its gyration be neither too quick nor too slow, the succession of the colours may be discern'd through the *Prisme*, whilst to the naked eye of a Bystander they exhibit whiteness.

There is something still remaining to be said of this Experiment

ment. But this, I conceive, is enough to enforce it, and so to decide the controversy. However, I shall now proceed to shew some other ways of producing *Whiteness by mixtures*, since I perswade myself, that this Assertion above the rest appears Paradoxical, and is with most difficulty admitted. And because the *Animadversor* desires an instance of it in Bodies of divers colours, I shall begin with that. But in order thereto it must be consider'd, that such colour'd Bodies reflect but some part of the Light incident on them ; as is evident by the 13 *Proposition* : And therefore the Light reflected from an Aggregat of them will be much weakned by the loss of many rays. Whence a perfect and *intense* Whiteness is not to be expected, but rather a Colour between those of Light and Shadow, or such a Gray or Dirty colour as may be made by mixing White and Black together.

And that such a Colour will result, may be collected from the colour of *Dust* found in every corner of an house, which hath been observ'd to consist of many colour'd particles. There may be also produced the like Dirty colour by mixing several *Painters colours* together. And the same may be effected by Painting a *Top* (such as Boys play with) of divers colours. For, when it is made to circulate by whipping it, it will appear of such a dirty colour.

Now, the Compounding of these colours is proper to my purpose, because they differ not from Whiteness in the *Species* of colour, but only in *degree* of Luminousness : which (did not the *Animadversor* concede it) I might thus evince. A beam of the Suns Light being transmitted into a darkned room, if you illuminate a sheet of White Paper by that Light, reflected from a body of any colour, the paper will always appear of the colour of that body, by whose reflected light it is illuminated. If it be a red body, the paper will be red ; if a green body, it will be green ; and so of the other colours. The reason is, that the fibers or threds, of which the paper consists, are all transparent and specular ; and such substances are known to reflect colours without changing them. To know therefore, to what *Species* of colour a *Grey* belongs, place any Gray body (suppose a Mixture of *Painters colours*,) in the said Light, and the paper, being illuminated by its reflexion, shall appear White. And the same thing will happen, if it be illuminated by reflexion from a *black* substance.

These therefore are all of one *Species* ; but yet they seem distinguished not only by *degrees* of Luminousness, but also by some other Inequalities, whereby they become more harsh or pleasant. And the distinction seems to be, that *Greys* and perhaps *Blacks* are made by an uneven defect of Light, consisting as it were of many little veins or streams, which differ either in Luminousness or in the Unequal di-

tribution of diversly colour'd rays ; such as ought to be caus'd by Reflexion from a Mixture of white and black, or of diversly colour'd corpuscles. But when such imperfectly mixt Light is by a *second* Reflexion from the paper more evenly and uniformly blended, it becomes more pleasant, and exhibits a *faint* or shadow'd Whiteness. And that such little irregularities as these may cause these differences, is not improbable, if we consider, how much variety may be caused in *Sounds* of the same tone by irregular and uneven jar-rings. And besides, these differences are so little, that I have sometimes doubted, whether they be any at all, when I have consider'd that a Black and White Body being plac'd together, the one in a strong light, and the other in a very faint light, so proportion'd that they might appear equally luminous ; it has been difficult to distinguish them, when view'd at distance, unless when the Black seem'd more blewish ; and the White body in a light still fainter, hath, in comparison of the Black body, it self appear'd Black.

This leads me to another way of *Compounding Whiteness* ; which is, That, if four or five Bodies of the more eminent colours, or a Paper painted all over, in several parts of it, with those several colours in a due proportion, be placed in the said Beam of Light ; the Light, reflected from those Colours to another White paper, held at a convenient distance, shall make that paper appear White. If it be held too near the Colours, its parts will seem of those colours that are nearest them ; but by removing it further, that all its parts may be equally illuminated by all the colours, they will be more and more diluted, until they become perfectly White. And you may further observe, that if any of the colours be intercepted, the Paper will no longer appear White, but of the other colours which are not intercepted. Now, that this *Whiteness* is a Mixture of the severally colour'd rays, falling confusedly on the paper, I see no reason to doubt of ; because, if the Light became Uniform and Similar before it fell confusedly on the paper, it must much more be Uniform, when at a greater distance it falls on the Spectators eye, and so the rays, which come from several colours, would in no qualities differ from one another, but all of them exhibit the same colour to the Spectator, contrary to what he sees.

Not much unlike this Instance it is, That, if a polish'd piece of Metal be so placed, that the colours appear in it as in a Looking-glass, and then the Metal be made rough, that by a confus'd reflexion those apparent colours may be blended together, they shall disappear, and by their mixture cause the Metall to look White.

But further to enforce this *Experiment* ; if, instead of the Paper, any White *Froth*, consisting of small bubbles, be illuminated by reflexion from the aforesaid Colours, it shall to the naked eye seem White, and yet through a good Microscope the several Colours will appear distinct on the bubbles, as if seen by reflexion from so many spherical surfaces. With my naked eye, being very near, I have also discern'd the several colours on each bubble ; and yet at a greater distance, where I could not distinguish them apart, the Froth hath appear'd entirely White. And at the same distance, when I look'd intently, I have seen the colours distinctly on each bubble ; and yet, by straining my eyes as if I would look at something far off beyond them, thereby to render the Vision confus'd, the Froth has appear'd without any other colour than Whiteness. And what is here said of Froths, may easily be understood of the Paper or Metal in the foregoing Experiments. For, their parts are specular bodies, like these Bubbles : And perhaps with an excellent Microscope the Colours may be also seen intermixedly reflected from them.

In proportioning the severally Colour'd bodies to produce these effects, there may be some niceness ; and it will be more convenient, to make use of the colours of the *Prisme*, cast on a Wall, by whose reflexion the Paper, Metal, Froth, and other White substances may be illuminated. And I usually made my Tryals this way, because I could better exclude any scattering Light from mixing with the colours to dilate them.

To this way of Compounding Whiteness may be referr'd that other, by Mixing light after it hath been trajected through transparently colour'd substances. For instance, if no Light be admitted into a room but only through Colour'd glass, whose several parts are of several colours in a pretty equal proportion, all White things in the room shall appear White, if they be not held too near the Glass. And yet this light, with which they are illuminated, cannot possibly be uniform, because, if the Rays, which at their entrance are of divers colours, do in their progress through the room suffer any alteration to be reduced to an Uniformity ; the Glass would not in the remotest parts of the room appear of the very same colour, which it doth when the Spectators eye is very near it : Nor would the rays, when transmitted into another dark room through a little hole in an opposite door or partition-wall, project on a Paper the *Species* or representation of the glass in its proper colours.

And, by the by, this seems a very fit and cogent Instance of some other parts of my *Theory*, and particularly of the 13 *Proposition*. For, in this room all natural Bodies whatever appear in their proper colours. And all the *Phænomena* of colours in nature, made either by Refraction or without it, are here the same as in the Open Air. Now, the Light in this room being such a Dissimilar mixture, as

I have describ'd in my *Theory*, the Causes of all these *Phænomena* must be the same that I have there assign'd. And I see no reason to suspect, that the same *Phænomena* should have other causes in the Open Air.

The success of this Experiment may be easily conjectur'd by the appearances of things in a Church or Chappel, whose windores are of colour'd glass; or in the Open Air, when it is illustrated with Clouds of various colours.

There are yet other ways, by which I have produced *Whiteness*; as by casting several Colours from two or more Prisms upon the same place; by Refracting a Beam of Light with two or three Prisms successively, to make the diverging colours converge again; by Reflecting one colour to another; and by looking through a Prism on an Object of many colours; and, (which is equivalent to the above mention'd way of mixing colours by concave *Wedges* fill'd with colour'd liquors,) I have observ'd the shadows of a painted Glass-window to become White, where those of many colours have at a great distance interfered. But yet, for further satisfaction, the *Animadversor* may try, if he please, the effects of four or five of such *Wedges* filled with liquors of as many several colours.

Besides all these, the Colours of *Water-bubbles* and other thin pellucid substances afford several instances of *Whiteness* produced by their mixture; with *one* of which I shall conclude this particular. Let some Water, in which a convenient quantity of Soap or wash-ball is dissolv'd, be agitated into Froth, and, after that froth has stood a while without further agitation, till you see the bubbles, of which it consists, begin to break, there will appear a great variety of colours all over the top of every bubble, if you view them near at hand; but, if you view them at so great a distance that you cannot distinguish the colours one from another, the Froth will appear perfectly White.

Thus much concerning the design and substance of the *Animadversor's* Considerations. There are yet some particulars to be taken notice of, before I conclude; as the denial of the *Experimentum Crucis*. On this I chose to lay the whole stress of my discourse; which therefore was the principal thing to have been objected against. But I cannot be convinced of its insufficiency by a bare denial without assigning a Reason for it. I am apt to believe, it has been misunderstood; for otherwise it would have prevented the discourses about Rarifying and Splitting of rays; because the design of it is, to shew, that Rays of divers colours, consider'd a part, do at *Equal* Incidences suffer *Unequal* Refractions, without being split, rarified, or any ways dilated.

In the Considerations of my first and second Propositions, the *Animadversor* hath rendred my Doctrine of *Un-equal Refrangibility* very imperfect and maimed, by explicating it wholly by the Splitting of rays; whereas I chiefly intended it in those Refractions that are perform'd without that suppos'd Irregularity; such as the *Experimentum Crucis* might have inform'd him of. And, in general I find, that, whilst he hath endeavour'd to explicate my Propositions *Hypothetically*, the more material suggestions, by which I design'd to recommend them, have escap'd his consideration; such as are, The Unchangeableness of the degree of Refrangibility peculiar to any sort of rays; the strict Analogy between the degrees of Refrangibility and Colours; the Distinction between compounded and un-compounded colours; the Unchangeableness of un-compounded colours; and the Assertion, that if any one of the Prismatic colours be wholly intercepted, that colour cannot be new produced out of the remaining Light by any further Refraction or Reflexion whatsoever. And of what strength and efficacy these Particulars are for enforcing the *Theory*, I desire therefore may be now consider'd.

12. Some particulars recommended to further consideration.

An Accompt of two Books.

I. *Ottonis de Guericke EXPERIMENTA NOVA MAGDEBURGICA, de VACUO SPATIO, &c.* Amstelodami A. 1672. in fol.

After that the famous Author of this Book hath made a Narrative of the chief *Hypotheses* and Opinions of both Antient and Recent Astronomers concerning the Systeme of the world, and represented the great difficulties in the *Ptolemaique* and *Tychonique*, and repeated the Answers to the Objections against the *Copernican*; he at large gives us his own Thoughts of the Frame and Constitution of the *World*; By which *World* he understands in this Treatise the Complex of the Planets, disposed and order'd much after the *Copernican* way, the *Sun* being seated in the midst, having his Spots about him, and moving and influencing all the rest of the Planets according to their several distances from him; *Saturn* making the utmost of all the Planets, and the End of this his *World* being there, where the diffusive power and vertue of the Sun, the King and Governor of them all, terminates; which bounds he conjectures to extend themselves, beyond *Saturn*, to those Fixt Stars that are of the nearer rank to *Saturn's* Orbe.

Concerning the Bodies lodged in these Planets, he thinks it consonant to the Power and Wisdom of the Great Creator, that there should be such a variety of them, as to stock each of the said Planets with

with creatures differing from those of others: so that nothing of what is in (e. g.) our Earth or Terr-aqueous Globe, is to be found in any of the other Planets, but that every one of them is stored with peculiar creatures, and even with such reasonable ones, as are of another kind from the Men of our Earth.

As to the *Space* that is between those his Mundan Bodies (the Planets,) he conceives it to be not any thing Material or Corporeal, but a *Meer Space* void of all body, which *Space* he defines to be as 'twere the Universal Vessel containing all Bodies; declaring herein his dissent from *Des. Cartes*, in whose opinion *Space* or Extension cannot be without an extended substance: whereas he (our Author) makes *Space* indifferent to the being or not being filled with bodies.

Treating of this *Space*, which he calls *Void*, and esteems so in its own nature, he maketh it Immense and Infinite: And discussing that so much agitated Question, whether there be a *Vacuum*, he concludes it in the Affirmative, asserting, that not only all those parts of his *Space*, to which the Effluvia or Expirations of his World do not reach, are void of all body, but also, that so much of Water, Air, or any other thing as is exhausted out of vessels, no other body succeeding in its room, so much there is of Vacuity there. To prove which latter, he repeateth in this volume many of those Experiments of his, which the Learn'd *Schottus* had publish't before: adding some others, together with some improvements of his Engin; which was also described by the said *Schottus*, and in which two very considerable things were deficient, as is observ'd by Mr. *Boyle*, the Noble Author of the *New Experiments Physico-Mechanical touching the Air*, p. 6, 7. in the first English Edition, printed A. 1660. at Oxford, and enrich't since, by the same, with a *Continuation of New Experiments touching the Spring and Weight of the Air, and their effects*, printed A. 1669. in the same place: Which two Treatises being compar'd with what hath been heretofore publish't by the aforesaid *Schottus*, and now by this Author, it will easily appear to sagacious and impartial Readers, to which of these two Gentlemen, Mr. *Boyle* and Mons. *De Gericke*, the Curious are most obliged, there having been at first but six experiments made by the latter of them, publish't by *Schottus*, in *Arte Hydraulico-pneumatica*, about A. 1656, which afterwards were called *Antiqua* by the same, in his *Technica Curiosa*, printed A. 1662; in which are also recorded the other Experiments, call'd *Experimenta Magdeburgica Nova*, two years after Mr. *Boyles* lately mention'd first Book; the *Continuation* of which hath been abroad three years before this of *de Gericke* himself, now under consideration.

Concerning our Authors Contrivance of his *Virunculus* or little Man, made to indicate the Weight of the Air at any time, and to foretell Wind and Weather; since he thinks fit to make a secret of it, we must let him enjoy it alone, till he shall think good to disclose it.

But

But touching his Experiment of a New and before never used *Wind-gun*; (as he calls it) whereby, contrary to the common *Wind-guns*, in which by store of well-compress'd Air, Bullets may be shot, he teacheth, that by evacuating and weakning the Air, the like effect may be produced; as to this, I say, the Reader will find the same Principle made use of by Mr. Boyle in his lately-mention'd *Continuation*, the fourth Experiment about a *New Hydraulico-pneumatical Fountain, made by the Spring of un-compressed Air*.

As to the Experiment related by this Author l. 3. c. 7. of making Water fall in *vacuo*, with such a noise, as if it were a hard substance, it appears by the *Journal* of the *R. Society*, that such an one was made before that Illustrious company by Mr. Boyle some years ago.

For a conclusion of this Accompt, I shall take notice of an Experiment, mention'd by our Author, l. 5. c. 15; by which he thinks may be represented the chief Vertues, he enumerates of our Earth, perform'd by a Globe of Sulphur melted and cooled again, and then perforated, to traject an Iron *axis* through it for circumvolution; whereby, attrition being used withal, he affirms that the Impulsive, Attractive, Expulsive, and other vertues of the Earth, as he calls them, may be ocularly exhibited. How far this Globe and its performance may be confided in, the Tryals and Considerations of some Ingenious persons here may perhaps inform us hereafter.

II, *Tthesaurus MEDICINÆ PRACTICÆ; studio & operâ Thomæ Burnet Scoto-Britanni, M. D. & Medici Regis Ordinarii: Londini impensis R. Boulter apud insigne Capitis Turcæ in vico dicto Cornhill, 1672. in 4o.*

THIS Learn'd and Industrious Author, having considered the several abilities of Physicians, and the different ways of their writings respectively; some delivering Medical Institutions and Controversies; some commenting upon *Hippocrates* and *Galen*; others publishing Methods of Curing Diseases and Practical Physicks; others augmenting the Medical matter, and teaching the way of Preparing Medicines; many improving Anatomy; and not a few recording Observations and Consultations: Having, I say, considered this variety and diversity, he prefers the last way of all as appearing to him most useful to Mankind; and therefore undertaketh in this Work of his to give us a Treasure of Practical Physick, collected from the Observations and Advices of a great number of Physical Writers, both Ancient and Modern, such as he esteemed to be most considerable of that profession. In the doing of which, he enumerates in an *Alphabetical* order about 410 kinds of Diseases of humane Bodies, partly inward, partly outward; describing their nature and symptomes, and declaring withal the ways of cure, as they are

to be met with in those many Authors, he affirms to have carefully consulted : Of which there are by him alledged no less than 117.

Amongst all these Chapters of *Diseases* and their Cures there are interspersed many not common Observations of Nature, such as are: *That* the force of *Castoreum* is such, *That* about the Isles of *Fero*, the Fishermen, when their Boats are endangered by Whales, throw some of that substance into the Sea-water, which being beaten with it, the Fish immediately sinks to the bottom: *That* Vinegar may be preserv'd from all worms, by mixing a little Theriac therewith, and so exposing it in a close vessel to the Sun for a moneth, daily shaking it, and afterwards percolating it when settled : *That* there are men, that ruminate properly speaking, like Beasts that chew the Cud, and that some of such persons when opened after death, have either their *oesophagus* every where fleshy like a Muscle, or their stomach very rough and large ; Where 'tis also observed, that one of such ruminating men, did not at all chew the cud when sick, just like Oxen and Cows, that are said by country-people to do so neither, when they are not well: *That* a certain Sea-man, that had lived long at Sea, and contracted from a continual defluxion a Cough, which exercised his Lungs for two years, did at length cast out, together with blood, two considerable ramifications of veins, separate from all parenchymatous matter, shewing the corruption of the whole substance of the Lungs : *That* it hath been observed to be dangerous, to have a vein opened at once in both arms, or leggs, which is here called a *Neronian Venæ-section*, &c.

Errata to be corrected in Numb. 87.

Pag. 5067. l. penult, Tractatu. p. 5068. l. 43. Demonstratas. p. 5069 l. 10. non in AX. p. 5070. l. 23. particularem vel defensionem. *ibid* l. 35. pro 2PQL leg. -2PQL. *ib.* lin. 27. ad margin. lege, Vide Tab. II. Fig. III. p. 5071. l. 16. est media. *ibid.* l. 31 pro 1L $\frac{1}{2}$ leg. 1- $\frac{1}{2}$ Vc. p. 5072. l. 35 pro $\frac{4}{100000}$, l. $\frac{4}{100000}$, p. 5073. l. 18. pro quid. l. quin. p. 5074. l. 23. 27. &c. pro σ T. l. 6T. *ibid* l. 23. pro $\frac{1}{2}$ 2. l. S2. *ibid.* l. 31. pro $\frac{1}{3}$ D3 l. L D3. p. 5075. l. 2. pro $\frac{1}{4}$ LD3, $\frac{1}{4}$ LD2 *ib.* l. 29. l. It. pro idem. *ib.* l. 39. Hyperbola sit Scalena.

Errata in this Numb. 88.

Pag. 5087. l. 7. r. Bodies. p. 5094. l. 34. r. it must. (p. 5097. l. 9. r. and made to divaricate.

LONDON,

Printed for John Martyn, Printer to the Royal Society, 1672.

PHILOSOPHICAL TRANSACTIONS.

Decemb. 16. 1672.

The CONTENTS.

Some Observations, made by the Noble Rob. Boyle, about Shining Flesh, both of Veal and a Pullet; and that, without any sensible Putrefaction in those Bodies. A Description of a singular kind of Mushroom, yielding a Milky Juice, not to be endur'd upon our tongues; observed by Mr. Lister. An Extract of a Letter of Mr. Flamsteed, concerning the Appulses of the Moon and the other Planets to Fix'd Stars, by him calculated for the Year 1673; together with an Observation of the Planet Mars. The Calculations themselves. An Accompt of some Books: I. Prose de Signori Academici di Bologna. II. Relation de divers Voyages Curieux, de M. Thevenot, IV. Partie.

N n n n n

Some

Some Observations about Shining Flesh, made by the Honourable Robert Boyle; Febr. 15. 16⁷¹₇₂. and by way of Letter addressed to the Publisher, and presented to the R. Society.

Yesternight when I was about to go to bed, an *Amanuensis* of mine, accustom'd to make Observations, informed me, that one of the Servants of the house, going upon some occasion into the Larder, was frighted by something of Luminous that she saw (notwithstanding the darkness of the place,) where the meat had been hung up before: Whereupon suspending for a while my going to rest, I presently sent for the meat into my Chamber, and caused it to be placed in a corner of the room capable of being made considerably dark, and then I plainly saw, both with wonder and delight, that the joint of meat did in divers places shine like rotten Wood or stinking Fish; which was so uncommon a sight, that I had presently thoughts of inviting you to be a sharer in the pleasure of it. But the late hour of the night did not only make me fear to give you too unseasonable a trouble, but being joyned with a great Cold I had got that day by making Tryal of a new Telescope (you saw,) in a windy place, I durst not sit up long enough to make all the tryals that I thought of and judg'd the occasion worthy of. But yet, because I effectually resolved to imploy the little time I had to spare, in making such Observations and tryals, as the accommodations, I could procure at so inconvenient an hour, would enable me, I shall here give you a brief account of the chief circumstances and *Phænomena*, that I had opportunity to take notice of.

1. Then I must tell you, that the subject, we discourse of, was a Neck of Veal, which, as I learned by inquiry, had been bought of a Country-butcher on the Tuesday preceding.

2. In this one piece of meat I reckoned distinctly above twenty several places that did all of them shine, though not all of them alike, some of them doing it but very faintly.

3. The bigness of these Lucid parts was differing enough, some of them being as big as the nail of a mans middle finger, some few bigger, and most of them less. Nor were there figures at all more uniform, some being inclined to a round, others almost oval, but the greatest part of them very irregularly shap'd.

4. The parts that shone most, which 'twas not so easie to determine in the dark, were some gristly or soft parts of the bones, where the Butcher's Cleaver had passed; but these were not the only parts that were luminous; for by drawing to and fro the *Medulla spinalis*, we found, that a part of that also did not shine ill: And I perceived one place in a *Tendon* to afford some light; and lastly three or four spots in the fleshy parts at a good distance from the bones were plainly discovered by their own light, though that were fainter than in the parts above mentioned.

5. When all these Lucid parts were survey'd together, they made a very splendid shew; but 'twas not so easie, because of the moistness and grossness of the lump of matter, to examine the degree of their Luminousness, as it is to estimate that of Glowworms, which being small and dry bodies may be conveniently laid in a book, and made to move from one letter or word to another. But by good fortune having by me the curious *Transactions* of this month, I was able so to apply that flexible paper to some of the more resplendent spots, that I could plainly read divers consecutive letters of the Title.

6. The Colour that accompanied the light was not in all the same, but in those which shone liveliest, it seemed to have such a fine Greenish blew, as I have divers times observed in the tails of Glowworms.

7. But notwithstanding the vividness of this Light, I could not by the touch discern the least degree of Heat in the parts whence it proceeded; and having put some marks on one or two of the more shining places, that I might know them again when brought to the light, I applied a seal'd Weather glass, furnished with tincted spirit of wine, for a pretty while, and could not satisfy my self, that the shining parts did at all sensibly warm the liquor: But the Thermoscope, though good in its kind, being not fitted for such nice Experiments, I did not build much upon that tryal.

8. Notwithstanding the great number of lucid parts in this Neck of Veal, yet neither I, nor any of those that were about me, could perceive by the smell the least degree of stink, whence to infer any Putrefaction; the meat being judged very fresh and well condition'd and fit to be dressed.

9. The floor of the Larder, where this meat was kept, is almost a story lower then the level of the street, and 'tis divided from the Kitchen but by a partition of boards, and is furnished but with one window, which is not great, and looks toward the street, which lyes North-ward from it.

10. The wind, as far as we could observe it, was then at Southwest, and blustering enough. The Air by the seal'd Thermoscope appeared hot for the season. The Moon was past its last Quarter. The Mercury in the Barometer stood at $29\frac{3}{10}$ inches.

11. We cut off with a knife one of the luminous parts, which proved to be a tender bone, and being of about the thickness of a half Crown piece, appeared to shine on both sides though not equally; and that part of the bone, whence this had been cut off, continued joined to the rest of the Neck of Veal, and was seen to shine, but nothing near so vividly as the part, we had taken off, did before.

12. To try, whether I could obtain any juice or moist substance from this, as I have several times done from the tails of Glowworms; I rub'd some of the softer and more lucid parts, (which I caused to be purposely cut off,) as dextrously as I could, upon my hand, but I did not at all perceive any luminous moisture was thereby imparted; though the flesh seemed by that operation to have lost some of its light.

13. I caused also a piece of shining flesh to be compressed betwixt two pieces of glass, to try, how well the contexture of it would resist that external force; but I did not find the light to be thereby extinguished during the short time I could allot to the Experiment.

14. But supposing, that high rectified Spirit of wine might so alter the contexture of the body it permeated, as to destroy its faculty of Shining, I put a luminous piece of Veal into a CrySTALLINE phial, and pouring on it a little pure Spirit of wine that would have burned all away, after I had shaken them together, I laid by the glass, and in about a quarter of an hour or less I found that the light was vanished.

15. But water would not so easily quench our seeming fires; for having put one of them into a *China Cup*, and almost filled it with cold water, the light did not only appear, perhaps undiminished, through that Liquor, but above an hour after was vigorous enough not to be eclipsed by being looked upon at no great distance from a burning Candle, that was none of the smallest; and probably the light would have been seen much longer, if we could have afforded to watch out its duration.

16. Whilst these things were doing, I caused the Pneumatical Engine to be prepared in a room without fire, (that the Experiment might be tryed in a greater degree of darkness;) and having conveyed one of the largest luminous pieces into a small Receiver, we caused the candles to be put out, and the pump to be plied in the dark; but the

the diminution of light, after the pump seemed to have been employed for a competent while, appeared so inconsiderable, (whether because our eyes had leisure to be fitted to that dark place, or for what other cause soever,) that I began to suspect, that the instrument, having been managed in the dark, had leaked all the while. Wherefore causing the lights to be brought in, and a *Mercurial Gage* to be put into the Receiver; when we were sure that this glass was well cemented on to the Engine, the Candles being removed, the pump was set a work again; and then opening my eyes, which I had kept clos'd against the light of the Candles, I could perceive, upon the gradual withdrawing of the Air, a discernible and gradual lessening of the light; which yet was never brought quite to disappear (as I long since told you the light of Rotten Wood and Glowworms had done,) or to be so near vanishing as one would have expected; though upon the bringing in of the Candles again it appeared by the *Gage*, that the Pump had been diligently applied. But the room being once again darkened; by the hasty increase of light, that had disclosed it self in the Veal upon this letting in of the Air to the Exhausted Receiver, it appeared more manifestly than before, that the decrement, though but slowly made, had been considerable. This tryal we once more repeated with a not unlike success; which though it convinced us, that the Luminous matter of our included body was more vigorous or tenacious than that of most other shining bodies; yet it left us some doubts, that the light would have been much more impaired, if not quite made to vanish, if the subject of it could have been kept long enough in our Exhausted Receiver: But the unseasonable time of the night reducing me at length to go to bed, I could not stay to prosecute this or any other tryal.

17. Only, whilst I was undressing, this further Observation occur'd, that supposing there might be in the same Larder more joints of the same Veal than one, innobled with

with this shining faculty, it was found, that a Legg of Veal, which was caused to be brought into my Chamber, had some shining places in it; though they were but very few and faint in comparifon of thofe, that were conspicuous in the above-mentioned Neck.

18. What further *Phænomena* this morning might have afforded me, I cannot tell, having been haftily called up before day for a Niece, that I am very juftly and exceedingly concerned for, who was thought to be upon the point of death, and whose almoft gasping condition had too much affected and imployed me, to leave me any time for Philofophical entertainments, that require a calm, if not a pleafed, mind. Only this I took notice of, becaufe the obfervation could not coft me a minute of an hour, that whilft they were bringing me Candles for to rife by, I looked upon a clean phial, that I had laid upon the bed by me after a piece of our luminous Veal had been included in it, and found it to fhine vividly at that time, which was between four and five of clock this morning, fince when I have made no one obfervation or tryal.

P O S T S C R I P T.

19. Near two days after I had made the forementioned Obfervations, thofe horrid fymptoms of my Niece's difeafe, that had fo much alarmed the Phyfitians and me, being through Gods goodnefs confiderably abated, I began to refume the thoughts of our Shining Veal, and though, having in the hurry I was in forgotten to take any order about it, I found it was already difpofed of; yet the piece, I lately mentioned to have been included in a phial, being preferved in it, I looked upon it the third day (inclusively) after we had firft obferved the meat, 'twas cut off from, to be luminous; and I found it to fhine in the dark as vigorously as ever. The fourth day its light was alfo conspicuous, fo that I was able in a dark Corner of the room to fhew it

it even in the day time to three or four very ingenious Physicians, all of them (save one) members of the R. Society; and I presume I need not re-mind you, that the following night I invited you to be a *spectator* of it, though before that time the light had begun to decay and the offensive smell to grow somewhat strong: which seems to argue, that the disposition, upon whose account our Veal was luminous, may very well consist both with its being and not being in a state of *putrefaction*, and consequently is not likely to be derived meerly from the one or the other. The fifth day, in the morning looking upon it when I awaked, and before the curtains were opened, it seemed to shine better than it had done the day preceding. The same night also it was manifest enough, though not vivid, in the dark. When I awaked, the sixth day in the morning after the Sun was risen, I could within the Curtain perceive a glimmering light. But the seventh day, which was yesterday, I could not late at night discern any light at all.

You saw too much in what a condition I was, when you did me the favour to visit me, to expect that I should presume to entertain you with any Speculations about the cause of these unusual apparitions of light. 'Tis true indeed, that in some notes, I formerly mentioned to you, I endeavoured to make it probable, that whether Light depend upon a particular kind of Impulse propagated through a transparent *Medium*; or upon a Diffusion of extremely little parts from the Luminous body; or upon the Action of some other corporeal agent; what ever the Efficient be, the Effect is produced in a *Mechanical* way. But though I had these papers by me; yet to determine what peculiar Kind of motions or other operations Nature really employed in the production of a light, which seemed not clearly (by what I shall presently note) referable either to the particular and settled constitution of the *Animals*, whose flesh shined, (as in our Glowworms and some *American* flies;) or

or to that intestine and unusual motion of the parts, that causes or accompanies Putrefaction in Rotten Wood or Fishes; since upon the first and liveliest appearance of the Light, there was not any (at least that could be taken notice of by the senses:) To determine this, I say, it seem'd to me so difficult a task, that I shall willingly leave the Solution of such abstruse *Phænomenas* as some of ours, unattempted; especially since I may, God permitting, make an Historical mention of them the day after to morrow at the Meeting of the *Royal Society*; where I doubt not much more and more to the purpose will be said and consider'd, than I have vanity to think myself capable of offering. Only, for the prevention of some needless conjectures, to which without this previous Advertifement one might upon plausible grounds indulge, I shall in the mean while add and conclude with one Observation more, which may possibly take off our thoughts from striving to deduce the Shining of our Veal from the peculiar nourishment, or constitution, or properties of that individual Calf, whose flesh, &c. was luminous. For, having several nights sent purposely into the Larder, to observe, whether any Veal, since brought thither, or any other meat, did afford any light, a negative answer was alwaies brought me back; save at one time, which happened to be within less than 48 hours of that, at which the Luminousness of the Veal had been first taken notice of; for at this time there was in the same Larder a conspicuous light seen in a *Pullet*, that hung up there, which having caus'd to be brought up into a darkned place in my chamber in the night time, I perceived four or five luminous places, which were not indeed near so large as those of the Veal, but were little less vivid than they. All of these I took notice to be either upon or near the Rump, and that, which appear'd most like a Spark of Fire, shone at the very tip of that part. Yet was not this Foul mortified, nor at all ill-sented, but so fresh, that the next day I found it very good meat. But whether this may reasonably lead to

a suspicion, that the peculiar constitution of the *Air* in that Larder, and at that time, may as well deserve to be taken into consideration, as the peculiar nature of the *Animals* whose flesh did shine, is a question, that I, who have scarce time to name it, must not presume to do any more than name. And therefore as soon as I have begg'd your pardon for this tedious though hasty scribe, I shall without Ceremony subscribe my self, &c.

A Description of an odd kind of Mushroom, yeilding a Milky Juice, much hotter upon the tongue than Pepper, &c. Observed by Mr. Lister, and by him communicated to the Publisher, Novemb. 15. 1672.

THe 18. of *August* last I passed through *Marton* woods, under *Pinno-moor* in *Craven*: In these Woods I then found an infinite number of *Mushrooms*, some wither'd, and others new-sprung and flourishing. They were of a large size, something bigger than the *Ordinary red-gilled eatable Mushroom* or *Champignon*, and very much of their shape, that is, with a perfectly round Cap, or Stool (as we vulgarly call it,) thick in flesh and with open Gills underneath; having a thick, fleshy, not-hollow, and round Foot stalk, of about 6 fingers breadth high above ground, and ordinarily as thick as my thumb. If you cut any part of this Mushroom, it will bleed exceeding freely a Milk-white Juice, concerning which note: 1. That this Milky Juice tastes much hotter upon the tongue than Pepper. 2. That it is not clammy to the touch. 3. That the Air does not much discolour it, or the blade of a knife; as is usual with most Vegetable Juices. 4. That it became in the glass-viol, I drew it into, suddenly concret and stiff, and did in some daies dry into a firm Cake. 5. That it then also, when well dried, retain'd its fierce biting tast and white colour.

Further, I observ'd these Mushrooms, full of Juice, not to be endured upon our tongues, to abound with Fly-maggots.

Also

Also, the youngest and tendrest of them, that is, such as are most Juicy, to have been very much eaten by the *Grey meadow naked Snail*, lodging themselves within the sides of the plant.

Concerning this kind of biting Mushroom, I find in a certain late discourse of the *State of Russia* these words ; *Grooz-shidys Fungorum maximi, palmam lati, instar Omasi bibuli sunt, crassi & candidi; dum crudi sunt, succo (lacteo putà) abundant. Eos sicut Tithymallum muria corrigunt Rutheni ; aliter fauces & guttur inflammabunt. Ipse semel nimis inconsideratè assatos comedere tentabam, non sine suffocationis periculo.* The reference to the Cuts or Figures is here confused, and the description too concise, to say that Ours agrees in any thing with Theirs, save the great acrimony of the Juice they both yield.

I may sometime acquaint you with the Medicinal Uses, I have caused to be made of this *White Resin*: In the mean time I shall only mind you of the great affinity it hath with *Euphorbium*.

Since this Letter the Author thereof was pleased to give us this further Account in an other of *Decemb. 17. viz.*

—— Mr *Wray* return'd me this Answer to my Letter about the biting Mushroom ;

“ At my return to *Middleton* I found a Letter from you,
 “ containing the Description of a Mushroom by you disco-
 “ ver'd in *Marton-woods* under *Pinno moor*. I doubt not
 “ but it is that described in *Joh. Bauhin l. 40. c. 6.* under the
 “ title of *Fungus piperatus albus, lacteo succo turgens*. Only he
 “ saith ; 1. That it doth in bigness exceed the *Champignon* ;
 “ whereas you write, that there are few of them much big-
 “ ger than *that* : But yet in saying so, you grant them to be
 “ bigger, 2. He saith, for their bigness they are not so thick
 “ as *that* ; you describe yours to be thick in flesh. In all other
 “ points the Descriptions agree exactly. For the colour, that

“ it is white, Gills and all ; for the *place*, that it grows in
 “ woods ; and for the *tast*, that ’tis hotter than Pepper. Se-
 “ veral particulars mention’d by you, are not observ’d or
 “ not mention’d by him. I cannot say, that I have as yet met
 “ with this Mushrom.

*An Extract of Mr. Flamsteed’s Letter written to the Publisher
 from Derby Novemb. 16. 1672. concerning the Appulses, by
 him calculated for A. 1673. of the Moon, and the other Pla-
 nets to Fixed Stars ; together with an Observation of the
 Planet Mars, made by the same.*

— I Herewith send you my Annual task, but flight-
 ly done. Indeed my frequent Journeys and do-
 mestick busineses have kept me so employ’d, that I have
 not had time to make such Calculations as I intended. I
 have only noted the Time of the Moons true Conjunction
 with the Fixed Stars from the Learned *Heckerus* his *Ephe-
 merides*, with the point then ascending at *London* ; with a
 conjecture therefrom, when the Visible Occultations shall
 happen : from which the intelligent Observer may be su-
 fficiently inform’d, when to wait for any appearance, and
 what will be observable.

Besides, having of late observed, with my seven foot Tube,
 some Appulses of the other Planets to Fixed Stars, and col-
 lected all the Observable ones of the next year, I have ad-
 ded them to the *Lunar* Appulses. Both are very slender la-
 bours, but may be very useful.

September last I was at *Townley*. The first week that I
 intended to have observed δ there with Mr. *Townley*, I twice
 observ’d him, but could not make two Observations, as
 I intended, in one night. The first night after my
 return, I had the good hap to measure his distances from
 two Stars the same night ; whereby I find, that his *Paral-
 lax* was very small ; certainly not 30 seconds : So that I
 believe, the *Suns Parallax* is not more than 10 seconds. Of
 this

this Observation I intend to write a small Tract, when I shall gain leisure; in which I shall demonstrate both the Diameter and Distances of all the Planets by Observations; for which I am now pretty well fitted.

Having observ'd the Distances and Positions of the 3 Stars, by which δ made his *transit*, I find, that *Tycho* errs 5 minutes at least both in the Places and Latitudes of them compared one with another. And certainly he errs as much in many others; so that the labour of Monsieur *Hevelius* to rectify their places is very needful. Not that I find fault with *Tycho*; 'tis a wonder, (considering how difficult it is to set plain Sights to a small Star) that ever he performed so much and so well: But if M. *Hevelius* use not Glasses in their room, I fear, we shall but be where we were; and yet without this Restitution we cannot expect any thing certain, much less accurate, in Astronomy.

Luna

Lunæ ad Fixas Appulsus, Londini A. 1673. Observabiles: A locis
ejus veris, in Ephemeridibus Heckeri consignatis, prævisi, &
brevibus notis descripti à Joh. Flamsteed Anglo.

1673.

Januar.

d. h.

17. 8. 21. D cum Fixa in Π 3. 34. cum lat. Sept. 4. 36. Fixæ la-
título 3°-57'. horoscopus $\text{m} 29\frac{1}{4}$. Ergo Luna circa horam 9. ab-
scondet Stellam Australi limbo.

h.

22. 10. 4. D cum Fixa in Ω 18. 56. latitudo vera sua 0-46. Sept.
Fixæ latitudo 0°-16'. Sept. Horoscopus ≈ 11 . Propterea Luna ante
horam 9. abscondet \star^{am} medio limbi sui, vel circa paludem Marcoti-
dis. Eadem nocte,

Hora 16. 10'. Luna cum alia Fixa in Ω 22°-45'. Lune tunc vera la-
título 0° 25'. Sept. Fixæ 0°-00'. Horoscopus $\text{f} 17$. Ergo Lune
limbus borealis post horam ibit infra stellam.

24. 14. 7'. Lune in $\text{m} 22$ °-28'. latitudo Meridionalis 2°-5'. Fixæ
in eodem loco latitudo: item Mer. 3°-2'. Horoscopus $\text{m} 25\frac{2}{3}$. Ergo
Luna, paulo post mediam noctem, vel stellam limbo Austrino abscon-
det, vel modico intervallo supertransibit.

Februar.

d. h.

16. 11. 21. Luna in $\text{S} 14$ -19. latitudo ejus 3-36. Fixæ latitudo
2°-56'. Bor. Horosc. $\text{m} 12$. Ergo Luna, post semihoram, stellam
lucis 6^a medio limbi obscuri sui occultabit.

h.

17. 15. 51. Luna cum Fixa in Ω 2-48. latitudo vera 2-12. Sept.
Fixæ latitudo etiam Sept. 1°-14'. punctum oriens $\text{vp} 6$. Luna prop-
terea, post semihoram, Austrino limbo abscondet stellam.

h.

19. 7. 46. Luna in Ω 25. 52. latitudinem habet Aust. 1-5. Fixæ
1°-25'. Punctum Eclipticæ ascendens est $\approx 6\frac{1}{2}$. Ergo Luna ante ses-
quihoram boreali parte limbi obscuri stellam lucis 5^a abscondet.

Martii

h.

12. 5-59. Luna cum lucida Pleiadum latitudo 5-10. borealissima inter
Pliades 4°-28'. Sept. Horoscopus $\text{m} 23\frac{1}{2}$. Luna ergo ante horam 8.
australi limbo abscondet stellam.

h.

14. 7-11. Luna cum fixa in Π 23-59. latitudinem habet 4-40. Fixæ
tantum 4°-6'. Sept; oriente $\approx 15\frac{1}{2}$. Luna ergo Fixam medio limbi
obscuri, post semihoram, occultabit.

h.
18. 10. 57. Luna in Ω 22. 45. latitudo borea 0° . 27. Fixa ibidem 00° . 0'. horoscopus \cap 27. propterea Luna in nonagesimo, paulo antea, Ecliptica, boreali parte obscuri limbi abscondet stellam.

Aprilis

d. h.

13. 6. 45. Nondum subducto Horizonti nostro sole, Luna Praesepi \S juncta latitudo vera 1° . 51'. Sept. Praesepis 1° . 14'. Horoscopus \approx 29^{gr}. Ergo Luna in Nonagesimo limbi obscuri boreali quadrante conteget nebulosas.

Junii

d. h.

6. 8. 31. Luna in \S 25. 0. latitudo 2. 5. Sept. Fixa ibidem latitudo 1° . 15 $\frac{1}{2}$. punctum eriens \pm 28. Propterea Luna post horam 9^{am} medio obscuri limbi conteget stellam.

h.

8. 10. 51. Luna in Ω 25. 52. latitudinem habet 0° . 40. Aust. Stella 1° . 25'. etiam Australis. Oritur tunc \approx 15: propterea Luna descendens limbus si non attinget stellam, eam tamen quam proximè assequetur.

h.

9. 11. 21. Luna in \cap 10. 21. habet latitudinem 1° . 50. Aust. Fixa 2° . 29'. Oritur \times 3 $\frac{1}{2}$. Propterea Luna descendens stabit infra \times ^{am}.

h.

21. 15. 21. Luna cum Fixa in \approx 13. 8. latitudo 0° . 28. Aust. Fixa 1° . 16'. item Aust. Horoscopus \S 4 $\frac{1}{2}$. Ergo Luna post semihoram medio limbi lucidi abscondet stellam.

h.

29. 18. 00. Luna cum lucida Pleiadum latitudo 5° . 10. horoscopus Ω 9. Propterea oriente sole borealiores inter eas potest contegere.

Julii

d. h.

19. 14. 11. D° in \approx 21. 17. latitudo Sept. 0° . 19. Fixa latitudo in eodem loco 0° . 10'. Aust. Horoscopus \S 12. Deinde post 22'. temporis Luna cum sequenti stella, cujus locus \approx 21. 28. Lat. 0° . 14'. A. Quamobrem circa hor. 15. Luna contiguas fixas parte limbi boreali conteget.

h.

27. 16. 57. Luna cum Fixa in Π 3. 35. latitudinem obtinet 5° . 4. Sept. Fixa 3° . 57'. Oritur tunc Ω 19^{gr}. Luna transit supra stellam, cui proximè appropinquat, circa 16 hor.

Augusti

d. h.

22. 12. 11. Luna in \S 13. 58. cum latitudine boreali 5° . 12. Fixa cum ea latitudo 4. 8. B. Horoscopus \S 14. Propterea circa horam 10 $\frac{1}{2}$ p. m. Australi parte limbi lucidi abscondet Fixam.

23. 8^h-53'. Luna cum lucida Pleiadum in \odot 25°. 25'. cum latitud. Sept. 5°-12'. Horoscopus \odot 22°. Quamobrem Luna tunc exorta stellas Pleiadum praterit; à quibus tamen medico intervallo, tubis facile capaci-
oribus dimetiendo, distabit.

27. 15^h-17'. Luna in \odot 25-0. latitudo vera borea 2°. 2'. Fixæ cum ea latitudo 1°-15'. Horoscopus \odot 20. Ergo circa horam 13½ p.m. Luna fixam occultabit in Australi parte limbi lucidi.

Septembris

19^d. 14^h-24'. Luna erit in \odot 25°-25'. cum 5°-01'. latitud. septentrionali: Oritur tunc \odot 27. Luna propterea in nonagesimo limbus Austrinus borealiores teget Pleiadum, qui tunc tamen à media \odot lucida 15 min. ad boream distabit.

Octobris

9^d. 11^h-31'. Luna in \approx 21°. 28'. latitudo borealis 0°-33'. Fixæ cum ea latitudo 0°-14'. Austr. Horoscopus \odot 9. Quamobrem Luna circa horam 12½ fixam hanc, & huic contiguam, paulo ante occasum suum, Austrino limbo teget.

17. 11^h-21'. Luna in Π 3°-35'. ejus latitudo 4. 42. Sept. Fixæ cum ea latitudo 3-57. Horoscopus \odot 12. Quamobrem circa horam 10. eam in Australi parte lateris lucidi abscondet.

Novembris

12^d. 9^h-49'. Luna in \odot 13°-58'. latitudinem habet 5. 0. Sept. Fixæ cum ea 4°-08'. Sept. oriente \odot 14½. Luna propterea, tunc in ipso Nonagesimo sita, vel fixam austrino limbo teget, vel modico ab ea intervallo distabit.

13. 5^h-56'. Luna lucida Pleiadum verè juncta latitudinem habet veram borealem tantum 4°-52'. Horoscopus tunc \odot 2. Propterea in Australi corporis sui semicirculo mediam lucidam abscondet Luna, in boreali borealiores. Appulsus 1^a circa solis occasum, ceteris subinde ordine conspiciendus.

Decembris

10^d. 16^h. 0'. Rursus Luna cum lucida Pleiadum, latitudinem obtinet 5°. 0'. Sept. Horoscopus \mathbb{M} 11°. Quamobrem Luna mox occidentalem subteget, & paulo ante occasum, lucidam.

11. 6^h. 6'. Luna in Π 3°-35'. latitudo Sept. 4°. 43'. Fixæ cum ea 3°-57'. Horoscopus \odot 7. Luna ergo circa 5^h. medio corpore stellam teget.

13. 10^h. 41'. Luna in \odot 5. 23. latitudo vera 2. 54. Sept. Fixæ 2°-11'. Horoscopus \mathbb{M} 17°. Quamobrem Luna plena paulò postea stellam occultabit medio Australis semicirculi.

*Reliquorum quinque planetarum ad Fixas Appulsus, eodem Anno
1673 observabiles; ab iisdem J. Heckeri Ephemeridibus
deducti à J. Flamsteed.*

	d.	Hor.	Planetarum loci.	Latitud. planet.	Distantiæ à fixis in Longitud.	In Latitud.
Jan.	6	6 vesper.	♂ in ♍ 22°-59' 0". 36' E.	13 in ant. 20° ♍ is cum	1—2 ad Austr.	
	6	vesper.	♀ in ♋ 0-09 1—33 Au.	44 in ant. 15 ♍ is cum	0—23 Austr. ab ea	
	13	6 vesper.	♀ ♋ 7-30 1—23 Au.	25 in cons. 23 ♍ cum	1—03 Austr.	
	15	6 vesper.	♀ ♋ 9-58 1—20 Au.	3 in ant. 24 ♍ cum	0—04 Borea.	
	17	6 vesper.	♀ ♋ 12-25 1—16 Au.	14 in ant. 25 ♍ cum	0—16 Austr.	
Febr.	4	6 mane	♂ ♋ 0-30 1—04 E.	8 in ant. 6 ♍	0—16 Bor.	
	5	6 vesper.	♂ ♋ 10-36 0—57 E.	cum stella 13 ♍ is	0—10 Austr.	
	7	6 mane	♂ ♋ 2-43 0—23 E.	24 in ant. 10 ♍	0—08 Bor.	
	8	6 vesper.	♂ ♋ 12-28 0—58 E.	5 in cons. 12 ♍ is	0—14 Austr.	
	13	6 vesper.	♀ ♋ 15-01 0—03 E.	20 in ant. 13 ♋ um	0—54½ Austr.	
	14	6 vesper.	♂ ♋ 16-12 1—01 E.	4 in ant. 9 ♍ is	0—44 Austr.	
Martii	6	6 vesper.	♂ ♋ 28-40 1—09 E.	12 in ant. 24 ♍ is	0—03 Austr.	
	7	6 vesper.	♀ ♋ 10-34 1—29 E.	2 in ant. 13 ♍ is	0—22 Bor.	
	8	6 vesper.	♀ ♋ 11-42 1—33 E.	41 in ant. 12 ♍ is	0—21 Bor.	
	9	6 vesper.	♀ ♋ 12-50 1—37 E.	27 in cons. 12 ♍ is	0—25 Bor.	
	12	6 vesper.	♀ ♋ 16-11 1—49 E.	5 in ant. 9 ♍ is	0—03 Bor.	
	14	6 vesper.	♀ ♋ 18-55 1—57 E.	27 in ant. 11 ♍ is	0—39 Austr.	
	14	6 vesper.	♂ ♋ 03-41 1—11 E.	2 in cons. 23 ♍ is	0—36 Bor. }	
	16	6 vesper.	♀ ♋ 20-58 2—05 E.	14 in ant. 22 ♍ is	0—07 Bor. }	
	18	6 vesper.	♀ ♋ 13-38 1—36 E.	5 in cons. 26 ^x Aurigæ	0—27 Austr.	
	18	6 vesper.	♀ ♋ 13-38 1—36 E.	cum stella 9 ^a ♍ is	0—09 Austr.	
	20	6 vesper.	♂ ♋ 7-27 1—12 E.	9 in ant. 20 ♍ is	0—32 Bor.	
Aprilis	10	7 vesper.	♀ ♋ 16-39 1—41 E.	23 in cons. 9 ♍ is	0—05 Austr.	
	12	7 vesper.	♀ ♋ 10-33 1—35 E.	3 in cons. 8 ♍ is	0—48 Austr.	
	14	7 vesper.	♂ ♋ 23-7 1—16 E.	11 in cons. 27 Aurigæ	0—10 ad Bor.	
	17	8 vesper.	♀ ♋ 23-28 3—34 E.	30 in ant. 24 Aur.	0—32 ad Austr.	
	18	8 vesper.	♀ ♋ 24-22 3—35 E.	23 in cons. 24 Aur.	0—31 Austr.	
Maii	10	8 vesper.	♂ ♋ 9-24 1—16½ E.	14 in ant. 21 ♋ is	0—14 Austr.	
	11	8 vesper.	♂ ♋ 10-1 1—16½ E.	23 in cons. dictæ fixæ	0—14 Austr.	
	16	8 vesper.	♀ ♋ 14-14 2—43 E.	5 in ant. 8 ^x ♋ is	0—13 Austr.	
	28	4 mane	♂ ♋ 13-26 2—31 E.	h cum fixa 14 ^x ♋ um	1—0 Austr.	
Junii	4	8 vesper.	♂ ♋ 25-1 1—15 E.	1 in cons. 8 ^x Cancr.	0—0½ Austr. *	
	10	8 vesper.	♂ ♋ 2-33 1—13 E.	15 in ant. 1 ^x Cancr.	0—1 Austr.	
Julii	28	8 vesper.	♀ ♋ 13-38 1—10 E.	14 cum stella 9 ^a ♍ is	0—35 Austr.	

	d.	Hor.	Planetarum loci.	Latitud. planet.	Distantiæ à fixis in Longitud.	In Latitud.
Aug.	17	4 mane	♀ ♄ 18-50	3° 37' Au	16' in ant. 27° ♄ ^{rum}	0—11 Bor.
	18	4 mane	♀ ♄ 19-42	3—31 Au	36 in conf. 27 dictæ	0—17 Bor.
	26	5 mane	♀ ♄ 27--0	2—44 Au.	4 in conf. 10 Canceri	0—26 Austr.
Sept.	5	5 mane	♀ ♄ 6--48	1—40 Au.	1 in ant. 12 ♄ ⁱ	0—14 Bor.
	12	6 mane	♂ ♄ 22--14	1—00 E.	3 in conf. 17 ♄ ^s	0—41 Austr.
	20	6 mane	♀ ♄ 22--38	0—26 A.	7 in ant. 10° ♄ ^s	0—26 Austr.
	22	6 mane	♀ ♄ 24--48	0—16 A.	30 in ant. Cordis ♄ ^s	0—42 Austr.
	23	6 mane	♀ ♄ 25--54	0—12 A.	36 in conf. Cordis ♄ ^s	0—38 Austr.
	28	6 mane	♀ ♄ 1--31	0—11 B.	18 in ant. 15° ♄ ^s	0—03 Bor.
Octob.	1	6 mane	♀ ♄ 0--21	1—37 E.	4 in conf. 6 ♄ ^s	0—12 Bor.
	5	6 mane	♀ ♄ 9--27	0—40 E.	32 in ant. 38 ♄ ^s	0—40 Austr.
	6	6 mane	♀ ♄ 10--36	0—43 E.	37 in conf. dictæ stellæ	0—37 Austr.
	11	5 mane	♀ ♄ 13--40	1—57 B.	2 in conf. 9 ♄ ^s	0—12 Bor.
	13	5 mane	♀ ♄ 18--39	1—06 B.	17 in ant. 11 ♄ ^s	0—50 Bor.
	16	5 mane	♀ ♄ 22--10	1—15 E.	23 in ant. 5° ♄ ^s	0—32 Bor.
	23	6 mane	♀ ♄ 00--29	1—32 E.	13 in conf. 6° ♄ ^s	0—07 Bor.
	29	6 mane	♂ ♄ 2--15	1—03 E.	7 in ant. 24 ♄ ^s	0—31 Bor.
	31	6 mane	♀ ♄ 10--04	1—47 E.	22 in conf. 1° ♄ ^s	0—08 Bor.
Novem.	3	7 mane etiam	♂ ♄ 2--27 ♀ ♄ 13--38	0—32 B. 1—50 E.	4 in conf. 24° ♄ ^s cum fixa 9° ♄ ^s	0—00½ B. vers. * 0—05 Bor. *
	5	7 mane	♂ ♄ 4--00 ♂ ♄ 3--47	1—01 E. 0—31 E.	4 in conf. 13' ♄ ^s	0—30 Boreali.
	10	6 mane	♀ ♄ 22--05	1—55 E.	6' in ant. 17° ♄ ^s	0—10 Bor.
	15	6 mane	♂ ♄ 10--33	0—25 B.	1' in conf. 1° ♄ ^s	0—01 Austr. *
	23	6 mane	♂ ♄ 7--43 ♀ ♄ 8--00	1—02 E. 1—52 E.	4 à ♄ . 53' circ. ♄	0—50 Boreali.
	24	7 mane	♂ ♄ 9--17	1—51 E.	26' in ant. 2° ♄	0—04 Austr.
Decemb.	8	6 mane	♂ ♄ 26--21	0—12 B.	16 in conf. 12 ♄	0—05 Bor.
	10	6 mane	♂ ♄ 10--33	1—03 E.	1 in conf. 1° ♄	0—37 Bor.
	11	6 mane	♀ ♄ 0--16	1—28 E.	11 in conf. 5° ♄	0—14 Austr.
	12	6 mane	♂ ♄ 29--09	0—10 E.	♂ cum fixa 6° ♄	1—04 Austr. *
	24	7 mane	♀ ♄ 16--30	0—58 B.	14 in ant. 27 Ophiuchi	0—34 Austr.
	26	7 mane	♀ ♄ 19--00	0—54 B.	22 in conf. 30 Ophiuchi	0—04 Austr. vers.

Stella Jovis in Ephemeride assignati loci deficiunt hoc anno 13'. ab iis quos cælitus observavimus : propterea ejus omnes ad Fixas appulsus ante duos & amplius dies quam consignantur observari possunt. At in ♂^{is} & ♀^{is} ad eum applicationibus, eadem 13 min. ipsius loco adjeci ; ut, si aliquid à descripta Planetarum positione observat a dissentiat, in illorum solis locis peccare Ephemerides credantur.

Sic omnes majorum Planetarum ad Fixas appulsus, Tubo Optico gradum unum recipiente, observabiles, brevi tabellâ complexus sum. Ne nos ulla observandi præterlaberetur opportunitas imprævisa, curæ fuit. Vestrum dehinc, fidi Cælispectes, fuerit, ne harum ulla neglecta pereat : Ab his enim accuratè si tandem fixarum loci restituantur (quod plurimum desideratur,) optimè veri planetarum motus cognosci, restitui, & cælis annuentes tabule construi possunt : quod in votis habet

*Cælorum & Cælispectum
Assiduus Cultor*

An Account of some Books.

I. Prose de Signori Academici di Bologna; in Bologna, 1672 in 4°.

THis is a Complex of 15. Discourses, at several times made by several persons of the Illustrious Academy of *Bologna*, publish'd under the Presidentship of the Noble Count *Valerio Zani*. Though these dissertations be all ingenious and learned, each in their kind; yet we shall here chiefly take notice of the last of them (as most suitable to the design of these Tracts,) composed by the Excellent Signor *Montanari*, concerning the admirable Changes and other Novelties observ'd in the Heavens. Touching which subject the Author scruples not to affirm against the fond Maintainers of the Immutability and Incorruptibility of the Celestial Bodies, that there is not one Constellation, which serveth not for an Instance of wonderful Novelties and frequent Changes, either by the Accession of New Stars not discover'd before, or by the Extinction of some of those that had been observ'd formerly, or by increase of Light in some, or the diminution of it in others. In the proving of this Assertion he is very particular; yet so that he refers the Reader to a large Treatise, he is now preparing under the Title of the **INSTABILITIES** of the **FIRMA-MENT**; not doubting but that he shall make it out to the Assertors of the *Incorruptibility* of these Visible Heavens, that even in the Stars anciently described there are observ'd such Changes, as would be sufficient to make *Aristotle* himself, if alive, change his opinion in this point.

Amongst the many particulars, in which this Author instanceth to make good his Affirmation, such as are the Constellations of *Andromeda*, *Perseus*, *Ursa*, *Draco*, and almost all the Northern ones, he noteth, that, having of late years found a considerable diversity in the *Pleiades*, and the numerous Stars there-about, from them as they were described by *Galilei*, he hath taken the pains of describing them anew by a Telescope of 20 palmes, (that is, about $13\frac{1}{2}$ foot,) and exhibited them in this very Tract. Nor

Nor does he doubt, but these Changes in the Fixt Stars have been frequent in other times; unregarded therefore because it seem'd to men too absurd, that such glorious parts of Nature, as the Heavens and Stars are, should also be subject to such vicissitudes and alterations; as if the manifold Wisdom and Power of the Great Creator and Supreme Governor of the Universe did not as well shine forth from the one, as the other.

If it be objected, that the Appearance and Dis-appearance of those Stars may be ascribed to their Elongation from, and Proximity to our Eyes: He answers, *first*, That of all the Celestial Motions there being observ'd none but what are Circular or at least approaching to Circular, if we should think so of the Fixt Stars that appear anew, then the Plane of that Circle being over the Plane of our Eye, the Upper part of that Circle must needs be remoter from the Lower part, for Stars of the second Magnitude, more than six times at least; that is to say, that the Star in disappearing to our Eye must be removed at least six times farther off than when it appeared brightest: In which case we must needs see that Star move in an apparent straight line, or in an Arch of a great Circle of above 19 degrees; which is most contrary to all Observation, by which it is notorious, that none of them do recede from their apparent first place. *Secondly*, That not only in the lately mention'd *Hypothesis* of the Circle, but also supposing the Motion of such stars through a straight line passing directly over our Eye, the said distances of those Stars, six times multiplyed by us, would not be sufficient to save the *Phænomenon* of being seen for a determinate time, and then to disappear; but it would be requisite to suppose in a manner an infinite profundity of the Stellar Sphere: an Exorbitancy not to be admitted, where no other reason urgeth to do it than the salving of such Appearances. All which he largely explaineth in his discourse; concluding it with a Consideration, which imports, that, since Astronomers do now generally agree, that the

Fixt

Fixt Stars are, like the Sun, enobled with their own native Light, he sees no inconvenience in it to affirm, that they must also be subject to the incursions of such Spots, as the Sun is, which frequently augmenting about them do obscure, impair, or quite abscond their Light, & that sometimes for a long, sometimes for a short time, & by turns, according as the matter, of which they are made up, gathers together in great or small quantity. And therefore if such bodies upon a sudden meet about any Star, which for many ages, being free from such darkning matter, did shine very bright to us, what wonder, it should be obscured, or vanish altogether? Again, if any Star, which before had alwaies about it such a quantity of Spots, as that for a long time it was counted to be (for example) of the fourth Magnitude, do unexpectedly unvail its face, it will then shine forth and challenge possibly the place of a Star of the second or first Magnitude: Again, if any Star, having been for many ages confin'd to a dark prison among these Spots, do break Prison and show its formerly restrain'd Light; what wonder, if there appear to us a New and never before seen Star? And if by a new collection of Spots it return to its former imprisonment; what wonder, if we lose again the Splendor of it? Lastly, if one only part of the body of any Star lets out its internal lustre, and have a periodical motion about its own Center; you'll see it, no less than that of Bullialdus's in the *Whale*, appear at certain determinate times, untill a new mass of collected Spots, or a new Opening of the same do occasion an unexpected alteration.

These our Author proposes as *Possible Causes* of such Effects; remitting those, that require *Indubitable* ones, to that of *Lucan Pharsal. l. 1.*

*Querite quos agitat Mundi labor; at mihi semper
Tu, quæcunque moves tam crebros Caula meatus,
Ut Superi voluere, late*—————

So much of this Exercitation, which we consider as most proper for our purpose. As for the others, we shall but
name

name some of them, *viz.* Of all sorts of Equestrian Games and Exercises; of all sorts of Baths,, and the various Entertainments therein, of the several Sects of Philosophers, and the Genuin Method of Philosophising, here esteem'd to be the Experimental way; of the Physical Causes of the reputed Sympathies and Antipathies of things; of Musical Intervals, and of Musick in general; of Moral Philosophy, &c.

II. *Relation de divers Voyages Curieux, IV Partie. A Paris, 1672. in fol.*

THis Fourth part of the Curious Voyages of the worthy M. Thevenot is as yet but begun, there being only printed of it and transmitted to us two Discourses, the one containing a Pourtraiture of the *Indians* by D. Juan de Palafox, Bishop *de la Puebla de los Angeles*; the other being a Relation of the Voyages of N. N. into the River *della Plata* and from thence over Land into *Perou*.

Concerning the former, the said Bishop having in *New-Spain* for several years exercised the Charge of Visitor and Vice-Roy as well as Bishop, and thereby acquired a perfect knowledg of the evils, which those *Indians* were made to suffer, he presented this discourse to Philip IV. King of *Spain*, to acquaint him with the Innocence of those people, the ill treatment they lay under, and the remedies that might be administred for it.

In describing their nature and manners, he affirms, that there can hardly be any people more humble, more gentle and less interessed; that never are idle, but alwaies employed by the Strangers set over them; that know no Envy; that are very chaste except when overtaken with drink, which they are the more subject to, because they eat but little. Though they are good natured and seemingly innocent, yet, *saieth he*, they want no wit; of which he alledgeth many Examples: Among others praiseth the sagacity, by which one of those *Indians* convinced a *Spaniard* to have stolen his Horse. For, when that *Indian* saw that the Judge, what pains
foever

soever he took in examining the accused party, could find no proof of the Theft, he threw his cloak over the stolne Horses head, asking the Theif, of what Eye the Horse was blind? The thief, being puzzled, and yet unwilling to appear mute, answer'd at random, of *the right Eye*. Whereupon the *Indian*, uncovering the Horses head, said, 'Tis plain, the Horse is none of thine, for thou knowest not, that he is neither blind of the right nor of the left Eye.

Besides, he taketh notice, that there are good Musicians amongst them, that manage their voyce well; that play on all sorts of Instruments, and sound a Trumpet very well; that have Musick-books in their Chappels, and Masters of Musick in all the Parochial Churches.

Further, he tells us, that they are very dextrous in cutting and polishing Pretious-stones, of which also and their virtues they are said by him to be very skilful; as they also are of the virtues of Plants, whence they draw good and very succesful remedies against many diseases and infirmities.

Again, he commends both their dexterity and courage, in that they cast themselves stark naked into the water, and getting upon the back of a Crocodile, take the opportunity, when the Beast opens his throat, to put a stick of half an Ell long betwixt his teeth, and so draw him with a cord, tyed to the stick, a shore, &c.

The *other* Discourse is made by one *Acarete a Biscayan*, who having sailed A. 1657. from *Cadix* to *Buenes-ayres* in the Southern *America*, about the Mouth of the River *dela Plata*, was sent from thence over Land into *Perou*, which is above 400 Leagues; in which Voyage he made many not contemptible Observations. He stay'd some time at *Potosi*, where he saw the Silver-and-Gold-Mines, and assisting at the magnificent solennity celebrated for the Birth of the Prince of *Spain*, he was an Eye-witness, that the Streets, where the Procession pass'd, were paved all along with barres of Silver.

He describes very exactly the Countries of *America*, he pass'd through; noting the Scituation of the places, the Animal

nimals and Plants to be found there, the Temperature of the Air, the Manners of the Inhabitants, their number, their wealth, and the commodities they trade in.

He observes, that about the Upper part of the river *Uruguais*, towards *Parana* and the Province of *Paraguais*, there are rich Gold-mines, discover'd by *Jesuites*; of which the Gold is much finer than that of *Perou*.

In the same Province grows an Herb call'd Herb of *Paraguais*, ordinarily given to the Mine-men afflicted by the Sulphureous and other damps of the Mines, who are recover'd by drinking the decoction thereof, which makes them vomit up with great ease whatever troubles their stomach.

In the way from *Buenos-ayres* to *Perou*, about *S. Jago del Estro*, as he met with Tigers very fierce, so he found the Lyons very gentle. About the same place he found those Animals call'd *Guanacos*, as big as Horses, with long necks, little heads, and short tayls; having in their stomach the *Bezoar-stone*.

Speaking of the *Ostriches* abounding in that Country, he relateth a remarkable thing, which he saith he hath seen, viz. That, when that Bird is hatching her Eggs, and they are ready to hatch, she breaks four of them and carries them to the four corners of the place she is hatching in: which Eggs thus broken coming to corrupt, there is in a little time bred out of them a great quantity of worms, with which the young ones, when hatched, are fed untill they are able to go and seek for their food elsewhere, &c.

Errata in this Tract.

P. 5108. l. 2. r. *March* for *Febr.* p. 5115. l. 7. r. *Phenomena*.

L O N D O N,

Printed for John Martyn, Printer to the Royal Society,
1672.

PHILOSOPHICAL TRANSACTIONS.

Januar. 20. 16⁷²₇₃

The CONTENTS.

A further Accompt concerning the Existence of Veins in all kind of Plants ; together with a Discovery of the Substance of these Veins being Membranous, as also of some Acts in Plants resembling the Acts of Sense ; likewise of the Agreement of the Venal Juice in Vegetables with the Blood of Animals, &c. Communicated by Mr. Lyfter. The Copy of a Letter from Somersetshire concerning a Strange Frost which hath lately done much hurt about Bristol ; together with some useful hints suggested upon that occasion. An Extract of a Letter written by Monsieur Slusius, giving his short and easie Method of drawing Tangents to all sorts of Geometrique Curves. An Accompt of some Books ; I. A Discourse concerning the Origin and Properties of Wind ; by R. Bohun. II. Deux Machines propres à faire les Quadrans avec tres-grande facilité ; par le P. Ignace Gaston Pardies, S. J. Two Advertisements ; one, concerning a Body of Algebra in English, by Mr. John Kersey now in the Press ; the other, a System of Musick, ready to be publish'd by John Birchencha Esq;

A further Account concerning the Existence of Veins in all kind of Plants ; together with a Discovery of the Membranous substance of those Veins, and of some Acts in Plants resembling those of Sense ; as also of the Agreement of the Venal Juice in Vegetables with the Blood of Animals, &c. Communicated by Mr. Lister in a Letter of Januar 8. 16⁷²₇₃ and exhibited to the R. Society.

S I R,

WE have formerly given you certain reasons for the Existence of *Veins*, (analogous to those in Animals) in all Plants whatsoever, not Mushrooms excepted: To which we might add others of later notice ; as the skin of a plant may be cut sheer off with part of the spongy *parenchyma*; and no signs of Milky juice follow, that is, no breach of a vein. Again, we have stript the Plant of its skin, by pulling it up by the roots, and exposing it to the wet weather, untill it became flaccid as a wet thong, without any injury to the Veins, which yet upon incision would freshly bleed. These Experiments, I say, make against the general opinion of one only sap loosely pervading the whole plant, like water in a sponge.

And though we have made these and many other Experiments to facilitate an ocular demonstration of these Veins ; yet we have not been able to effect it to our mind, and subject them as nakedly to our eye as we could wish, for a through-information of their Use, and a minute and accurate discovery of all the particular Accidents belonging to them as such vessels. This, I say, is a work of much labour and patience ; and that which renders matters very difficult, is the infinite number, smallness and perplexity of these Plants.

In the Transverse cuts of Plants, we see as it were a certain Order and Number of the bloody orifices of dissected veins. We observe also in a Leaf, which we take to be the simplest part of a plant,

1. That

1. That the Veins keep company with the Ribbs and Nerves (as we vulgarly call them,) and are distributed into all the parts of the Leaf, according to the subdivisions of those nervous lineaments, and are disposed with them into a certain net-work; whether by Inosculations or bare contact only, we pretend not to determine.

2. That in a Transverse cutt of a Leaf, the middle Fibre or nerve, for example, seems to yield one big drop of a Milkie juice, springing as it were from one vein; yet the Microscope plainly shews us, that there are many veins which contribute to the making up of that drop.

3. That if a Fibre or nerve be carefully taken out of the Leaf, the Veins will appear in it like so many small hairs or pipes running along and striping the nerve.

4. That those many veins are all of an equal bigness, for ought we have yet discerned to the contrary.

5. That though we seem to be more certain of the ramifications of the Fibres, wherein those veins are, we yet are not so, that those veins do any where grow less and smaller, though probably it may be so. That which makes us doubt it, is the exceeding smallness of these veins already, even where we might probably expect them to be Trunk-veins and of the largest size; and being there also in very great Numbers and running in direct lines along the fibre, we guess, that one or more of them may be distributed and fall off on either hand with the subdivisions of the fibres, and not suffer any diminution in their Bulk.

6. That we cannot discern any where throughout the whole plant larger or more capacious veins, than those we see adhering to the fibres of the Leaves; which do also appear from comparing the bleeding Orifices in a transverse cutt. I have found it a difficult and laborious task, to trace and unravel them throughout the whole plant.

Our opinion is, that these Veins do still keep company with their respective Fibres. And as all the Fibres of the Leaf are joined in the Stalk of the Leaf, and that stalk ex-

plicated in cloathing the Twig or Stem of the plant, (which we take to be the reason of the orderly breaking forth of the Leaves,) so do we think of the Veins, their perpetual companions. And, as we have said, the Fibres of the Leaves are joined in the Twig; so are those of the twigs in the Branches; those of the branches in the Trunk or body of the tree: The like also in an inverted order we seem to observe in the several Coats and Ramifications of the Root. This the several Circles of bleeding Orifices in transverse cuts seems to confirm.

But moreover in the Roots of plants, if a simple Coat be separated and exposed betwixt your eye and the light, the Veins appear to be strangely intangled and implicate, and not in the same simple order as in the Leaves. The like we think of the Bark of the bodies of Trees, which we cannot distinguish from the Roots of plants; though there is, indeed, something (at least at certain seasons of the year) in the Root, which is not to be found in any part of the plant besides.

From what hath been said, it may well be doubted, whether there is any *sinus* or common Trunk, into which all the veins are gathered? But rather, that there are a multitude of equally big veins, each existing apart by it self. We indeed have found it very difficult so to exhaust the plant of its milkie juice, as to kill it, though we have given it very many incisions to that purpose. Divers other instances there are, which favour the Discontinuance of the Veins, and the little relation and intercourse they have with one another; as one branch of a Tree having fair and well grown fruit, before the other branches of the same tree and fruit blossom or have leaves; from the different situation and other circumstances of culture; the indefinite and perpetual growth of a Tree; the Cyon governing, &c.

And thus far we have taken our information concerning these Veins, partly by the appearance they make in transverse cuts, and partly by the help of a Microscope; which last indeed has shewed us something of their number,

magnitude, order, distributions, &c. And yet neither of these helps in our hands has satisfactorily discovered to us other particulars belonging to these vessels, as external Figure, Coats, Cavitie, &c.

The substance of these veins seems to be as truly *Membranous*, as the Veins of Animals: A Leaf will not give way and be extended, but the Veins in a leaf, if freed of all the woody Fibres, will be stretched out to one third part at least, and vigorously restore themselves again, just like a Vein, Gut, or any other membranous *ductus* of an Animal. Again these membranous Pipes are exceeding thin and transparent, because they suddainly disappear and subside after their being exhausted of their Juice; and particularly in that we see the liquor, they hold, quite through them, no otherwise than the blood through our Veins, or (in *Che-lidonium majus*, for example) a tincture of Saffron in Crystalline Pipes.

Concerning the External Figure of these Veins and Cavitie, as well as other Accidents, we thought, they would have been made more apparent to us, if it were possible to coagulate the Juice they hold without much shrinking the plant. We were in great hopes, *Freezing* would have effected this; which though it did not succeed as we promised our selves, in respect of the manifestation of these Accidents; yet it gave us some further light into the nature of the Juice of these veins. In the keenest frost, which hapned the other winter, we dissected the frozen leaves of the *Garden Spurge*. Here we observed, that all the Juice (besides that which these veins hold) was, indeed, frozen into perfect hard Ice, and to be expressed out in the figure of the containing pores; but the Milkie-Juice was as liquid as ever, but not so brisk as in open weather.

This Experiment we take to be good proof of the perfection of this Milkie Juice, and that it hath within it self so great a degree of fermentation, that it preserves it self and consequently the whole plant from the injuries of the weather; that is, the plant owes its life to it. Thus we have
seen

seen Insects (as *Hexapodi*-worms, &c.) ly frozen upon the snow into very lumps of Ice, which did not only cause the glass to ring we struck them against, but did endanger the breaking of it: And yet, put under the glass and exposed to the warmth of the fire, they quickly recovered their legs and vigour to escape; which we think could not be, unless the Vital liquor of their veins, as in this Instance of plants, had been untouched and little concerned in the frost. Further, we hence also argue the different *Uses* as well as *Natures* of these Juices, and look upon the frozen Icicles or that copious dilute and Limpid sap as *Alimental*; the Milkie and not frozen Juice, as the only proper *Venal*.

As to the motion of these Juices, these things are certain;

1. That the *Milkie* Juice alwaies moves and springs briskly upon the opening of a vein; the *Limpid* sap but at certain seasons, and as it were by accident, and not (as I judge) from any vital principle or fermentation of its own.

2. The *venal* juice hath a manifest intestine motion or fermentation within it self; witness (besides what hath been just now said of it) its contributing (and the long continuance of) that motion to the most insensible of liquors; and likewise its thick and troubled bleeding, like the rising of yeast, which yet in a few hours after drawing falls, and the juice becomes transparent, as the Gum of the *Virginian Rhus*, &c.

I shall not desire any person to acquiesce wholly in a bare fermentation; but endeavour a happy discovery of the Frame of *all* the parts of a plant, on which perhaps this motion may much depend. In the mean time we must indeed needs think (according to the knowledge we yet have of the parts of plants,) that these juices move by a far different contrivance of parts from that of Animals; not yet here discovering any uniting of veins into one common Trunk, no Pullation, no sensible stop by ligature, no difference in veins, &c. All which difficulties notwithstanding may, I hope, in time be happily overcome; and the Analogie betwixt Plants and Animals be in all things else,

as well as the motion of their juice, fully clear'd.

There seem to be in Plants manifest Acts of *Sense*. We instance in the suddain shrinking of some Plants; the frequent closing and opening of flowers; the critical erecting of the heads of Poppies from a pendulous posture, and particularly the *Vermicular* motion of the veins when exposed to the air. Again, the Veins of Plants may indeed be different, though at present we cannot tell wherein they are so. The Arteries within our heads are hardly to be known by the eye from the Veins. Further there are natural and spontaneous excretions or venting of superfluous moisture in plants, visible and constant, in the *Crown Imperial*, *Rorella*, *Pinguicula*, &c. As to the Ligature, as it hath been hitherto applied by us, it is not to be relied on for the discovery of this motion; the Veins only of plants being the parts probably distendable.

Lastly we shall not omit to tell you, that either we must take that away from the other reasons given of the necessity of the Circulation of the blood in Animals, *viz* the hindring of its breaking and clodding; or we must grant the same motion to the *Venal* juice in Plants: we having undeniable Experiments to shew, that the *Venal* juice of Plants and the *Blood* of Animals agree in this, that they both, when they are once drawn from their respective veins, do forthwith break and coagulate, and that the *serum* in the one as well as in the other becomes a stiff gelly by a little standing.

But of the different natures of the juices of these veins in divers Plants and their motion we will remain your debtor, and acquit our selves when we shall find it convenient; at present only acquainting you, what variety of Experiments hath taught us, that probably more useful preparations and certainly a truer Analysis and separation of the parts of vegetable Drugs may be effected, whilst they are in bleeding and liquid, than after they are once become concrete and have lost their natural Fermentation.

I am, &c.

The

The Copy of a Letter from Somersetshire, concerning a Strange Frost, which hath lately done much hurt about Bristol ; together with some useful hints suggested upon that occasion.

S I R,

I Have my self observed, and heard from others, that much violent Rain fell in many places of *England* this last Summer and Autumn 1672. And 'tis manifest, that such vehement showers do wash and carry away the Soil and richest Compost out of the common fields into the Rivers, and by them into the Ocean : Which is the cause of barreness and scarcity of Corn, and sometimes of a great mortality of Men and Cattle in the following years ; as I could make appear by many sad instances.

For a remedy against Famine, or to prevent it, some good Men, with much zeal for the publick welfare, have earnestly solicited *The Plantation of Orchards and Groves* ; having received it from a Tradition pretending to long Observation and frequent Experience, that in those years, in which Corn most fails, fruit, mast, chesnuts, wall-nuts, and such relief from our Trees, do most abound. But there is no sufficient defence against Divine Judgments, till we return to our duty. That Orchards and Groves will not do it, you may see by the *Narrative following* ;

The Freezing rain, which fell here the ninth, tenth, or eleventh of *December* last, (for I cannot confine the time exactly) hath made such a destruction of Trees in all the Villages and High-ways from *Bristol* toward *Wells* and towards *Shepton-Mallet*, and towards *Bath* and *Bruton*, and in other places of the West, that both for the Manner and Matter it may seem incredible ; and is more strange than I have found in any English Chronicle. You will have the proof and manner and best measure of it in a Transcript, which I shall here give you from a very worthy person of unquestionable credit, as you or others of your near acquaintance do well know.

" The late prodigious Frost (saith he) hath much disabled
 " many old Orchards exposed to the North-East. Had it con-
 " cluded with some gusts of Wind, it might have been of sad im-
 " portance; I weighed the Sprigg of an Ash-tree of just three
 " quarters of a pound, which was brought to my Table; the Ice
 " on it weighed sixteen pounds, besides what was melted off
 " by the hands of them that brought it. A very small bent at
 " the same time was produced, which had an Icicle, encompassing
 " it, of five inches round by measure: Yet all this while, when
 " Trees and hedges were loaden with Ice, there was no Ice to be
 " seen on our Rivers, nor so much as on our standing Pools. Now
 " we are seriously concerned for Replanting. Dated ^{Dec. 30.}_{72.}

Sir, The like, or worse and more strange complaints, I
 received from several other places, and from Eye-Witnes-
 ses of credit. Some Travellers were almost lost by the cold-
 ness of the freezing air, and freezing rain. All the Trees,
 young and old, on the high-way from Bristol to Shepton, were
 so torn and thrown down on both sides the ways, that
 they were unpassable. By the like obstructions the Carri-
 ers of Bruton were forc't to return back. Some were af-
 frighted with the noise in the Air, till they discerned that
 it was the clatter of Icy boughs dashed one against another
 by the wind. Some told me, that riding on the snowy
 Downs, they saw this freezing rain fall upon the snow, and
 immediately freeze to Ice, without sinking at all into the
 snow; so that the snow was covered with Ice all along, and
 had been dangerous, if the Ice had been strong enough to
 bear them. Others were on their Journey when the Ice
 was able to bear them in some places, and they were in
 great distress.

I said, I could not punctually define the time when this
 freezing-rain was most violent and most apparent. Dec. 8.
 much snow fell here; the ninth, much rain fell here; and
 all the snow passed away, not leaving an Icicle amongst
 us. The tenth day, we had suddain fits of cold and relax-
 ing warmth. On Wednesday (Dec. 11.) I saw a young
 man, who returning home from a Journey of five miles,

R r r r r

and

and coming into a warm room, cryed out of extream torments in all parts of his body. He affirmed, that the Air, and the Winds (which were then somewhat high) were so unsufferably cold, that he was in utter despair of coming home alive; yet all that day nothing but moist dew fell under our feet. If we say, the Earth did send forth warm steams to keep this freezing rain dissolved on her Surface; whence shall we say, the Air and Rain and Winds got these freezing Icicles, which oppressed men and plants? When the candid Frosts do cover our Fruit-trees perfectly white (as I have oft-times seen it hold for some weeks together) it is so far from doing hurt to the Trees, that we have it in a proverb for a good sign of abundance of fruit in the ensuing year: But for this Freezing rain, as soon as it touched any bough, settled into Ice, and by multiplying and enlarging the Icicles (especially where it could lay hold on Moss or other asperities of the Tree) it broke all down with the weight.

As soon as these Frosts were over, we had glowing heats, which caused a general complaint amongst us of excessive sweating, by night and day. The bushes and many flowers in the Garden appeared in such forwardness, as if it were in *April* or *May*. I saw young Coleworts growing; roots and leaves; on the top, leaves of an older Colwort. Not far from my abode, an Apple-tree blossomed before Christmas: This I do not mention for extraordinary; but I think, 'tis more than ordinary, that before New-years-tide this Apple-tree bore Apples perfectly knitted, and as big as ones fingers end. I had some of these apples brought to me, which I intended to send you; but they so withered in my pocket, that they have little resemblance of what they were a fortnight since, when they were green and plump.

It were to be wished, that some ingenious men would (instead of the conjectures of weather to come) give a faithful and judicious accompt of the weather, and other remarkable accidents and phænomena, as they fell out on the

the same day of the Month of the year foregoing. Hence we might in time examine upon some grounds, How far the Positions of Planets, or other symptoms or concomitants, are Indicative of Weathers. Probably we may have forewarnings of Deaths or Famines, Epidemical diseases, &c. and by their causes be instructed for remedies or prevention. Certainly, by this method we may learn more in few years than at random in all the days of our short lives. And, if such Calenders might be had from other forreign and remote parts, as from *Dantzick*, *Tangier*, *New England*, *Bermudos*, *Barbados*, *Jamaica*, &c; we should make a closer chase to investigate the cause of Heat and Cold, coasting Rain and coasting Winds. And this diligence would be profitable if observed from several parts of England, Sea-coasts, Midland, &c.

Neither would it less oblige posterity, if he, who writes the *London-Calendar*, would record at the end of every month the highest and lowest price of Wheat, Rye, Barley, Pease, Beans, Oats, as they are sold in some chief Market in *London*; and abstract in one page the weekly Bills of Births, Burials, of Males and Females.

And the like Calenders are to be wisht from *Paris*, *Rome*, *Venice*, *Vienna*, *Madrid*, since Major *Grant* hath drawn us good Instructions, what manifold uses may be made from such informations, &c.

It cannot be expected, that we should soon have it registred under every month, the *Quantity and Weight of Rain* that falls every month, or in great showers, or long lasting rain. And though this would seem a dull work; yet it would signifie something to some purposes.

In old Histories I find, that Earthquakes, Inundations, Droughts, Famine, Pestilences, were each of them (in their several seasons, and sometimes one close on the heels of the other,) almost universal over the known world; sometimes raging from place to place several years together. As the Learned *Meade* relateth of a Pestilence, which in the days of *Gallus* and *Volusianus* began in *Aethiopia*, and for

fifteen years wasted all the Roman Provinces. *Zonaras* is his Author; and *Lipsius* his abettor in these words; *Nec alia unquam major lues mihi lecta, spatio temporum, five terrarum.* As plagues and famine, so storms and tempests, and (as far as I could collect) this frost, and some winds, (more in some places then in other) did run from one place, and break out in another at differing times and by short journeys, about ten miles at a time. Thunder is not often heard above twenty miles off; except when it rolls about in a large compass, or the sound is assisted by the conveyance of Woods, Forests, Rivers or Channels. Hence Correspondence will be necessary to perfect these Registers.

If such a *Kalendar* as is here proposed, were happily begun, the leading example would draw on and grow to afford us better Light, than hath been hitherto assured by all the remains of Astrology. And they may make acquaintance with others, who have a genius, imployment and opportunities fit to bear the trouble of drawing the Tables of Weather and remarkable fatalities. Forewarnings may prepare us to consult for Preventions or Remedies. In the year 1629 or 1630 there was a Dearth in *England*: And much talk there was then, that in *London* they had a way to knead and ferment boyled Turneps with a small quantity of meal; and that it made better Bread for whiteness, pleasantness, lasting and wholesomness, than is made of the finest flower or wheat. Turneps, Rapes, Carrets, Parsneps, Potatoes, and other Roots lye safe under ground from scorching heat, and are said to thrive best in the greatest rain. Potatoes were a relief to *Ireland* in their last famine. They yield meat and drink. But after all our diligence and contrivances, our only safeguard is, to serve him, that is the Supreme Governor and Disposer of all.

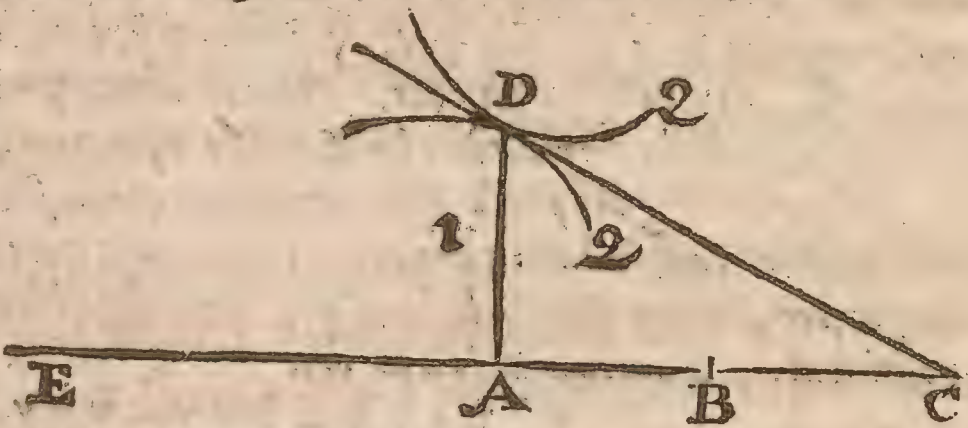
Jan. 13. 16⁷².

An Extract of a Letter from the Excellent *Renatus Franciscus Sim-
sius*, Canon of *Liege* and Counsellor to his Electoral High-
ness of *Collen*, written to the Publisher in order to be commu-
nicated to the *R. Society*; concerning his short and easie *Me-
thod of drawing Tangents to all Geometrical Curves* without any la-
bour of Calculation: Here inserted in the same language, in
which it was written.

— **M**ethodum meam ducendarum ad Curvas quaslibet Geometri-
cas Tangentium mitto ad Te, & Virorum Doctissimorum
R. Societatis censuræ submitto. Brevis mihi visa est ac facilis, quippe
quam puer ætatis tenlos doceri possit, & quæ absque ullo calculi labore
ad omnes omnino lineas extendatur: Malo tamen aliis talem videri quàm
mibi, cum in rebus nostris cecutire plerumque soleamus.

Fig. 1. Data sit igitur qualibet Curva DQ , cujus puncta omnia referantur ad Rectam quamlibet datam EAB per Rectam DA ; sive EAB sit diameter seu alia qualibet, sive etiam alia simul lineæ datæ sint, quæ, vel quarum potestates Equationem ingrediantur; parum id refert.

In Equatione Analytica, facilioris
explicationis causâ,
D^a perpetuò dicatur
v, B A, y. E B verò
& alie quantitates
date, Consonan-
tibus exprimentur.



Tum supponatur ducta DC, tangens curvam in D, & occurrens EB, producta, si opus sit, in puncto C; & CA perpetuò quoque dicatur a. Ad inveniendam AC vel a, hæc erit Regula Generalis;

I. Rejeſtis ab equatione partibus, in quibus y vel v non invenitur; ſtatuantur ab uno latere omnes in quibus eſt y , & ab altero illa in quibus habetur v , cum ſuis ſignis $+$ vel $-$. Hoc, dextrum, illud, ſiniſtrum latus, facilitatis cauſa, vocabimus.

2. In latere dextro, præfigatur singulis partibus exponens potestatis quam in illis obtinet v; seu, quod idem est, in illum ducantur partes.

3. Fiat idem in latere sinistro, præponendo scil. unicuique illius parti Exponentem potestatis quam in illa habet y . Sed & hoc amplius: Unum y in singulis partibus vertatur in a .

Ajo, Equationem sic reformatam modum ostendere ducende Tan-
gentis ad punctum D datum. Cùm enim eo dato, pariter data sint y &
 v , & ceteræ quantitates, quæ Consonantibus exprimuntur; & non po-
terit ignorari.

Si quid forte sit obscuritatis in Regula, aliquot exemplis illustrabitur: Data sit hac Aequatio $by - yy = vv$; in qua EB sit b , BA , y , DA , v , & queratur a sive AC talis, ut juncta DC tangat Curvam DQ in D . Ex regula, nihil rejiciendum est ab hac Aequatione, cum in singulis ejus partibus reperiatur y vel v . Ita quoque disposita est, ut ab uno latere sint omnes illius partes in quibus y ; ab altero, omnes in quibus v . Singulis itaque tantum præfigendus est Exponens potestatis, quam in illis habet y vel v ; & in latere sinistro unum y vertendum in a , ut fiat $ba - 2ya = 2vv$. Ajo nunc, hanc Aequationem ostendere modum ducenda Tangentis ad punctum D , sive $a = \frac{2vv}{b - 2y} = AC$.

Sic si data fuerit aequatio $qq + by - yy = vv$; eadem planè fieret cum priori Aequatio pro Tangente, abjecto scilicet qq , ut Regula præscribit.

Sic ex $2byy - y^3 = v^3$ fit $4bya - 3yya = 3v^3$ sive $a = \frac{3v^3}{4by - 3yy}$: Ex $bby + zyy + y^3 = qvv$, fit $bba + 2zya + 3yya = 2qvv$ & $a = \frac{2qvv}{bb + 2zy + 3yy}$: Ex $b^4 + by^3 - y^4 = qqvv + zv^3$, fit $3^6yya - 4ya^3 = 2qqvv + 3zv^3$ & $a = \frac{2qqvv + 3zv^3}{30yy - 4y^3}$.

Verum in similibus aequationibus nullam arbitror accidere posse difficultatem. Aliqua fortasse in illis occurret, quarum partes quadam constant ex productis y in v : Ut yv , $yyv - y^3vv$, &c. Sed hac quoque levis est, ut exemplis patebit. Detur enim $y^3 = bvv - yvv$. Nihil ab illa rejiciendum erit, cum in singulis ejus partibus reperiatur y vel v .

Sed ut ex Regula præscripto disponatur, bis sumendum erit yvv , & statuendum tam in latere dextro, in quo sunt partes quæ habent v , quam in sinistro, cujus partes habent y ; quandoquidem yvv , tam y quam v contineat. Faciendum igitur erit

$$y^3 + vvy = bvv - yvv.$$

Tum mutata, ut prius, hac aequatione in aliam $3yya + vva = 2bvv - 2yvv$, dabitur $a = \frac{2bvv - 2yvv}{3yy + vv}$.

Ita enim intelligenda est Regula, ut nempe in latere non consideretur potestas ipsius v , ideoque ipsi yvv Exponens vv præfigi non debeat, sed tantum ipsius y : Sicut contra ab alio latere, in yvv considerari non debet potestas ipsius y , sed tantum, eique suus Exponens præponi. Sic si foret $y^5 + by^4 = 2qqv^3 - yyv^3$, faciendum esset $y^5 + by^4 + v^3yy = 2qqv^3 - yyv^3$; & haberetur aequatio pro Tangente $5y^4a + 4by^3a + 2v^3ya = 6qqv^3 - 3yyv^3$ & $a = \frac{6qqv^3 - 3yyv^3}{5y^4 + 4by^3 + 2v^3y}$.

Atque his Exemplis arbitror, me omnem, quæ dari posset, Casuum varietatem complexum esse. Caterum non erit fortasse inutile, si ea quæ generatim exposui, ad lineam aliquam singularem applicem. Data sit igitur Curva BD , cujus ea sit proprietas, ut sumpto in illa quolibet puncto D , si jungatur BD , & erigatur ad illam normalis DE , occurrens rectæ BE in E , recta DE sit semper equalis datæ rectæ BF . Ut habeatur

habeatur Aequatio in terminis Analyticis, sit $DA = v$, $BA = \bar{y}$, BF Fig. 2]
vel $DE = q$. Erit itaque $EA = \frac{v}{y}$. Et cum quadratum DE aequale
sit duobus DA , AE ; erit aequatio $qq = \frac{v^4}{y^2} + vv$; sive $qqyy = v^4 + yyvv$;
qua pro Tangente, ex Regula praescripto, sic refo-
rmanda erit, $qqyy - vvyy = v^4 + yyvv$

$$2qq a - 2vv ya = 4v^4 + 2yyvv$$

$$a = \frac{4v_4 + 2yyvv}{2qqy - 2vvv}$$

Quomodo autem A-
quationes hujusmodi ad facili-
ores terminos pro constructione
reduci debeant, id sanè soler-
tem Geometram minimè late-
bit. Ut ecce in hoc Exemplo,

quoniam Rectangulum BAE supponitur aequale Quadrato AD , si EA dicatur e , erit $vv = ye$, & $v^4 = yye$, & $qq = ye + ee$. Itaque pro illis, posito in aequatione eorum valore, fit $a = \frac{4yyec + 2y3e}{2eev + 2evy - 2evy}$.

five $a = \frac{2ey + yy}{e}$, hoc est, $a e = 2ey + yy$ & addito ee utrinque

$ae^+ee = ee^+2ey^+yy.$ Erant itaque tres $e|e^+y|e^+a$, sive EA, EB, EC , in continua analogia, & facillima evadet constructio.

Ceterum, quoniam hactenus supposuisse videmur, Tangentem versus partes B ducendam esse, cum tamen ex datis accidere possit, ut vel parallela sit ipsi AB, vel etiam ducenda ad partes contrarias; definiendum nunc superest, quomodo hæc Casuum diversitas in Aequationibus distinguatur, Factâ igitur Fractione pro a, ut in Exemplis supra adductis, consideranda sunt partes tam Numeratoris quam Denominatoris, & earum signa.

1. Nam si in utroque, partes vel habeant omnes signum⁺, vel saltem Affirmatæ prævaleant Negatis, ducenda erit Tangens versus B.

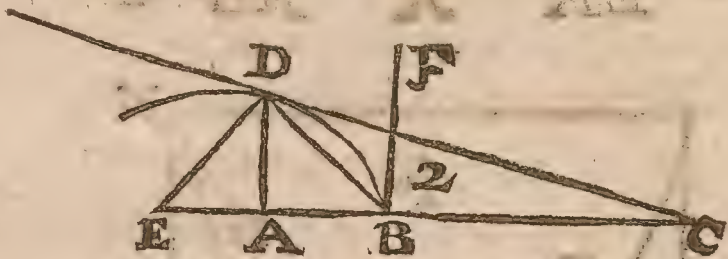
2. Si Affirmata prevaleant Negatis in Numeratore, sed aequales sint in Denominatore, recta per D ducta, parallela AB, tanget Curvam in D: hoc enim in casu, a est infinita longitudinis.

3. Si tam in Denominatore, quàm Numeratore, partes Affirmatae minores sint negatis; mutatis omnibus signis, ducenda erit rursus Tangens versus B: hic enim casus cum primo in idem recidit.

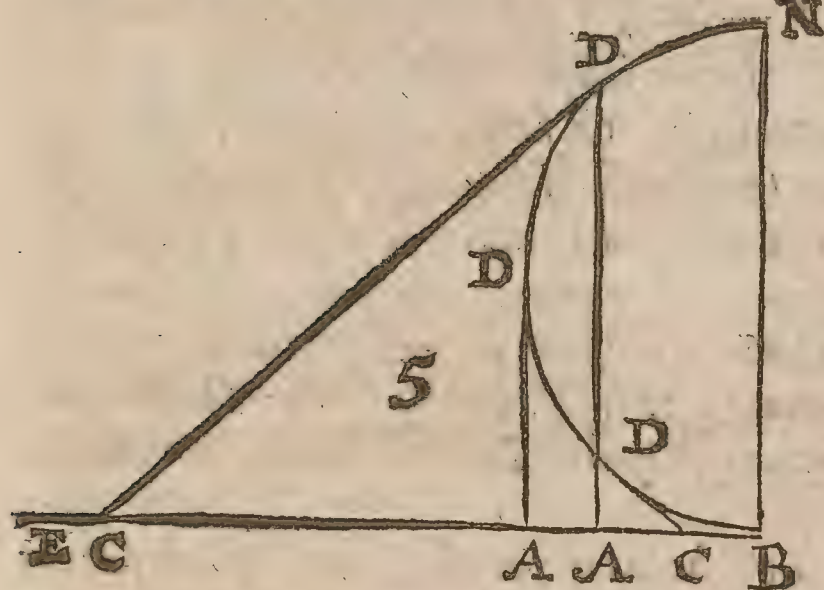
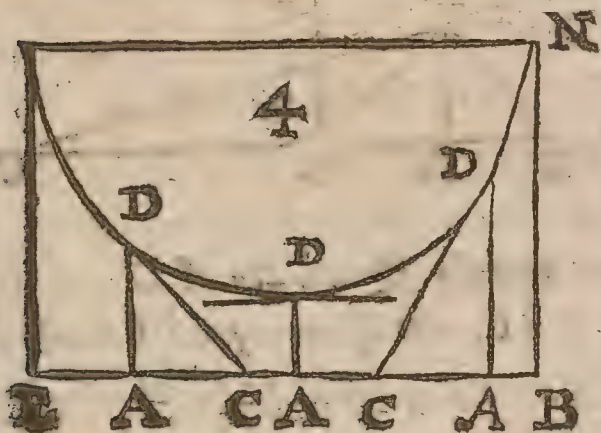
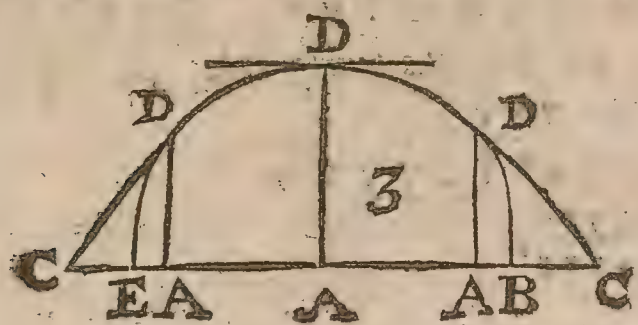
4. Si in Denominatore prævaleant, in Numeratore minores sint, vel contra; mutatis signis illius in quo sunt minores, ducenda erit Tangens versus partes contrarias, h. e. AC sumenda erit versus E.

5. Ac tandem si in Numeratore partes Affirmatae sint aequales Negatis, quomodocunq; se habeant in Denominatore, a abibit in nihilum. Itaq; vel ipsa AD erit Tangens, vel ipsa EA, aut ei parallela; quod ex datis facile dignoscitur. Horum autem Casuum varietas explicari potest per Aequationes ad circulum. Vid.

Vid.



Vid. Fig. 3. Sit enim Semi-circulus, cujus diameter EB , & in eo punctum D datum, ex quo cadat normalis $DA = v$. Sit $BA = y$, $BE = b$, erit aequatio $by - yy = vv$, & ducta Tangente DC , erit AC sive $a = \frac{2yv}{b - 2y}$. Nunc si b major sit $2y$, ducenda est tangens versus B ; si equalis, fit parallela EB ; sin autem minor, ducenda est versus E ; ut n. 1. 2. & 4. diximus.



Vid. Fig. 4. Datur rursus alius Semi-circulus inversus, cujus puncta referri intelligentur ad Rectam diametro parallelam, & eidem equalem, ut in schemate. Denominatis, ut prius, partibus, & $NB = d$, fit aequatio $by - yy = dd + vv - 2dv$. Igitur AC sive $a = \frac{2vv - 2dv}{b - 2y}$. Cum verò in exemplo supposuerimus, v semper esse minorem d ; si b sit major $2y$, ducenda erit Tangens versus E ; si equalis, erit parallela; sin minor, mutatis omnibus signis, ducenda erit versus b ; ut n. 4. 5. & 3.

Nulla autem ducenda esset Tangens, seu Tangens foret ipsa EB , si supposuissimus NB equalem semi-diametro, sive $2d = b$; ut n. 5.

V. Fig. 5. Sit tandem alius Semi-circulus, cujus diameter NB normalis sit ad rectam BE , ad quam ejus puncta referri intelligentur. NB dicatur b , & alia partes denominentur ut supra; fiet Aequatio $yy = bv - vv$; & $a = \frac{bv - 2vv}{2y}$. Jam si b sit major $2v$, Tangens ducenda erit versus B ; si minor, versus E ; si autem equalis, ipsa DA erit Tangens; ut n. 1. 4. & 5^{to}.

Et hæc est, ni fallor, Casuum omnium varietas, quæ ex Aequationum consideratione deprehendi potest.

Quomodo verò ex doctrina Tangentium constituentur Aequationum Limites, non est ut pluribus exponam, cum evidens esse existimem, maximam vel minimam applicatarum vel utramque simul determinari à Tangente parallela: de quo & aliàs ad Te scripsi, & aliquid etiam attigi

Miscelaneorum cap: ubi &, quâ ratione flexus contrarii curvarum ex Tangentibus inveniantur, ostendi. Eadem ratione reperitur quoque $\mu\omega\alpha\chi\delta\varsigma\lambda\omicron\gamma\epsilon\varsigma$, ut vocat Pappus, & multa alia; quæ si explicare vellem, liber mihi scribendus esset. Nam & in Physico-mathematicis Usus quoque hujus Regula opinione major est: Licet enim falsum sit Axioma, Naturam agere per lineam brevissimam; verissimum tamen est, Viam sequi determinatam, &, ubi nullam invenit, agere $\alpha\omicron\gamma\iota\varsigma\omega\varsigma$. De quo alias plura, si tanti Tibi visum fuerit: jam enim epistola modum excessi, ac vereor, ne, dum obscuritatem vitare satago, in prolixitatem inciderim. Adde tantum, me Regula meâ Demonstrationem * habere facilem, & quæ solis constet Lemmatibus; quod mirum Tibi fortasse videbitur. Vale. Dabam Leodii d. 17. Januar. CICIICLXXIII.

* Non dubitamus, quin rogatu nostro Illustris & Candidus hic Author Demonstrationem hâc indigitatam Nobis etiam brevi sit communicaturus.

An Accompt of some Books.

I. *A Discourse concerning the Origin and Properties of WIND, &c.* By R. Bohun Fellow of N. Coll. in Oxen. Printed at Oxford 1671. in 8^o.

THe Industrious Author of this Discourse, having consider'd with himself, how little Progress had been made, as in general, in the *History of Nature*, so, in particular, concerning the *History of Winds*, till our Voyages to the *East and West-Indies*, and the great advancement of Navigation in this and the precedent Age, furnish't us with so many new Discoveries and Improvements in all Natural knowledge, especially in the Motions of the *Winds and Seas*; that we must acknowledge the Insufficiency of the Theories received from the Schools of the Antients; having, I say, considered this, and withall met with frequent opportunities of conversing with the most Experienced of our Sea-Captains, giving him good information of the Course of the *Trade-winds*, the *Indian Monsoons*, the several sorts of *Brises* in the *African and American Climates*, *Hurricanes*, and other tempestuous Winds: Endeavoureth in this Discourse to give a fuller Accompt of this Subject than former Writers have done; proceeding therein, as he assureth the Reader, with great caution, in seldom making use of any Account of Voyagers, but when several Relations did agree in the same Particulars, or when he

found the Relators to be persons of un-suspected Integrity: Occasionally adding diverse Philosophical Reflections, in which he adhereth not to any one *Hypothesis*, but maketh use of several, as they to him seem to serve best for the Explication of the present *Phænomena*.

1. Then, he discourseth of the Opinions of the Antients, and compareth with them the Placits of the Moderns, considering *Wind* to be a Sensible Motion or Protrusion of the Air.

2. He examines the *Local Origins* of Wind, and compriseth them under Three general Heads; as generated 1. In the *Lower Region*, by the Dilatation of Vapours or Air; by a surcharge of the Atmosphere; by the Pressure of Clouds, or the Elastical power of the Air. 2. From the *Earth* or *Seas*, as from Sub-marine or Sub-terranean Eruptions; where he gives divers Historical Instances of Winds breaking from under the Earth or Sea, and particularly of the famous *Mascarets* in the River of *Dordogne*, and the sudden Tumors in the Lake of *Geneva*. 3. By *Descent* from the *Midle Region*; where he makes their Gravity to be the Cause of their Descent, not their Repulse from the *Antiperistasis* of Contraries.

3. He ventures to explicate the Fluxes and Reflexes of the Air and Winds, and their Motions to several Quarters, and that, by the most Violent Impulse made that way where they find the *medium* most yielding, and fittest to propagate their motions.

4. He gives the reason, why some winds blow with greater violence than others; observing, that those which are nearest their *Local Origins* blow hardest, especially such as are re-inform'd by other auxiliary vapors as they pass.

5. He considers the *Essential Attribute* of Winds to be their *Transverse Motion*, and inquires into the various Causes of the same; discoursing withall of the other *Secondary Affections* of Winds; as their *Undulation*, *Repercussion* from Promontories, *Opposition*, &c. Where he endeavors

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endeavors to explain, how it comes to pass, that one Wind blows on the Top of a Mountain, and a quite contrary in the Vally below ; and why in the main Sea, Winds keep the same Quarter a long time , but near mountainous Islands or Shoars they whistle up and down, and shift from one point of the Compass to another ; Observing also, that sometimes Contrary winds do rencounter together, and that by their ballancing one another a Calme ensueth.

6. He treats of the *Matter* of Winds, their *Limits* and *Extent*, and the *most Windy* Seasons ; giving an account, why they blow more in Spring and Autumn, than at other times.

7. He proceeds to the History of the *General* or *Trade-wind*, alledging the Causes why it blows constantly from the *Easterly* points, and imitates the Course of the Sun : Instructing us withall, where it is to be expected on this side of the Tropique ; as also of the Variation thereof in several *Longitudes*, and the Cause of the blowing of the *Westerly* winds without the Tropiques.

8. He treats of *Provincial* winds, such as wander not far from their native fountains, and terminat in those Regions that gave them birth.

9. He gives the History of the *Land* and *Sea-Brises* ; when they come in, or cease, in the *Straights*, on the Coasts of *Guiny*, and the *East* and *West-Indies* ; and what Accidents hasten or retard their approach.

10. He discourses of the *Anniversary Winds* ; their several species, and particularly those in the way to the *East-Indies*, called the *Monsoons* : How many months they continue the same Course on the Coast of *Afrique* and *India* ; together with the Changing and Breaking up of the *Monsoons*, and the danger there is then at Sea when they do so.

11. He examines the *Qualities* of Winds, derived from their *Constituent Parts*, or the *Medium* they pass through. Where he descends to the Consideration of the Properties of *Easterly*, *Southerly*, *Westerly* and *North-winds* ; inserting

divers remarquable Observations concerning them, and giving a Caution withall, to be used in Judging of the Qualities of Winds. Here also come in his remarques concerning *Het* and *Cold* Winds, and the examination of their Causes; concluding this Head not only with observing some *Unusual* Qualities of Wind, and the different odd Impressions they make upon other Bodies; but also delivering some proposals, for a more accurate Discovery of the Nature and Qualities of Winds, in relation to Navigation, Architecture, and several Trades and Mechanical Arts.

12. He inquires into the *Prognosticks* of Winds, from the different Appearances of the Celestial Bodies, from the Roaring of the Sea, the Resounding of Echo's, the peculiar Actions or Passions of some Living creatures, &c.

13. He subjoins an Historical account concerning *Whirlwinds* in general, and *Tornados*, *Hurricanes*, and other Tempestuous Winds; concerning which he delivers several uncommon and very remarkable Relations.

As to the whole matter, He is well aware, that it Will be hard to lay down any perfect *Theory* of Winds, in regard that the great *Inequalities* in the Superficies of the Earth; the several Obstacles and *Repercussions* from mountains; the different Situations of the places and *Mediums* in which they blow; the Distance of those Countries from the Poles of the World; their *Respects* to the Course of the *Sun*, whether they comply with, or resist, the *Natural Motion* of the Air from East to West, &c; have many intricate and nice speculations, not easie to be stated.

II. *Deux Machines propres à faire les Quadrans, avec très grande facilité; par le P. Ignace Gaston Pardies S. J. A Paris 1673. in 12^o.*

THE Learned Author, Professor of the Mathematiques in the Parisian College of *Clermont*, having found, that the difficulty, met with in the *Practick* of *Dyalling*, and in

in that tedious train of divers operations that are to be made in following the common method, generally taketh away the pleasure that would be in the exercise of a work that else is so curious and useful; is of opinion, that those Inventions will be much esteem'd, that shall make this practise easie. And in order thereto, he describes and explains in this Tract two *Engines*, which to him seem very proper for that purpose; forasmuch as he finds, that by the means of them a man may learn in less than an hour the way of making all sorts of *Dyals*, and may practise what he has learnt, as 'twere by playing, drawing them upon Walls and in his Chamber with the greatest facility.

He adds, that we are not to imagine, that the Use of these Instruments is but such a Mechanical Operation, where a man works blind-fold, not knowing what he doth: And he declares, that, as to *Operation*, those Practises that are simplest and surest are to be held the best and the most geometrical; and he is of opinion, that scarce any thing can be done with less trouble or with more certainty than by means of these Machines. But then, if the question be, to learn the *Theory* of *Dyalling*, he believes not, that it can be better done than by the Use of these very Engines; wherein he affirms that the Learner may easily be made to understand the Reason of all the Operations, the Respect of the Horary lines to the Course of the Sun, the Sections which the Arches of the Signs do make, and, in a word, the whole Science Gnomonique.

The Description and Explication of these Instruments doth so much depend upon the view of the Schemes, employed therein, that it cannot be well made without them: Which maketh us refer the Curious Reader to the Tract it self, now come over, wherein the necessary Schemes are annexed to the Discourse.

Advertisement.

T Here is now in the Press a Body of Algebra in English, recommended thereto by some of the Members of the R. Society, Composed by that known Mathematician of London, Mr. John Kersey. This Mathematical Art being that, by which chiefly Des-Cartes rendered himself so famous, as did Vieta before him, and since many of the English, French, and Dutch Nation; but no Elements of it in an entire Body being yet well digested in the English Language: this skilful Author hath taken the pains of digesting the choicest things of this Science, which lay dispersed in sundry Books, that are either very scarce and almost unprocurable, or very dear: A work, which, as it will doubtless prove very useful for all sorts of Ingenious Students of the Mathematicks in England, especially those that are not acquainted with Latin, French or Dutch (in which Languages the Books of those Sciences are mostly extant,) so it cannot but redound to the honour of this Nation, to have that done, whereby even the uncommon and abstruser parts of Learning and Knowledge are laid open and made intelligible to all such Capacities here, as are Lovers thereof.

Now as for the Encouragement of the Booksellers, a considerable number of persons have already subscribed, how many Books of this Work they will take off for themselves and their Friends; so was it thought fit, in this Tract to give further notice, that, though a good part of this Work be already printed, yet if any others shall be desirous to subscribe the Paper, printed by the Book-sellers for such Subscriptions, they shall be still received, addressing themselves to Thomas Passenger, or Benjamin Hurlock (living upon London-Bridge,) the Undertakers of this Work, who will assure all Subscribers, that they shall not pay by Three shillings so much for each Book, as they will be sold for in any shop. The Terms, on which they are to have the Books, are; $1\frac{1}{2}$ pence a sheet, which is the cheapest price; and the Money not to be paid but upon the Delivery of the Books. The whole will take up at least 170 sheets.

To give the Curious a short view of the Contents thereof; he will find in the

First Book; The four Species of Algebraic operations both in Integers and Fractions: The Rule of Three in Algebraic Quantities: The Extraction of Roots out of Simple Quantities, as also out of a Quadratic Quantity consisting of three Terms: The compleating of an Algebraic Square consisting of three Terms, when one is wanting; together with a Collection of easie Questions to exercise the preceding Rules: Of an Equation, and the Reduction of Equations: How to convert Analogies into Equations, and Equations into Analogies: The Resolution of Simple Equations exercis'd in 28 Questions both in Numeral and Literal Algebra: The Resolution of such Compound Equations, wherein there are two different Powers of the Quantity sought, and the Lower of those Powers

ers is the Square root of the Higher ; together with 28 Questions, exercising such Compound Equations, resolved also in both kinds of Algebra : Of Arithmetical Progression, where Mr. Oughtred's 20 Questions upon that subject are explained.

The Second ; The Compleat Doctrine of the Extraction of all kinds of Roots, both in Numbers and Letters : Of Geometrical Proportion : Theorems about Continual Proportionals ; together with 20 Questions about the same, resolved by Literal Algebra : How to find out all the Aliquot parts or Just Divisors as well of Numbers as of Quantities expressed by Letters ; and to find out the smallest Number that shall have a given Multitude of Aliquot parts : The Arithmetic of Surd Numbers and Surd Quantities, expressed by Letters ; where also of the nature and construction of Binomials, and how to extract Roots out of them : An Explication of Sim. Steven's General Method of resolving all manner of Equations in Numbers : Extractions out of Vieta and Des-Cartes for the like : The manner of resolving Questions by putting a different Letter for every Quantity unknown, when many are sought : The manner of resolving Questions which have Innumerable Answers.

The Third Book is a Comment upon the hardest and choicest Questions, that are found in the second, third, fourth, fifth and sixth Books of Diophantus his Arithmetic ; with other Questions of the like nature, invented upon the same Grounds by Vieta, Bacher, Fermat, and others.

The Fourth shews the Use of Algebraical Art in the Geometrical Resolution and Composition of plane Problems, viz. such as may be effected by drawing only Right Lines, and describing the Circumferences of Circles : Where the manner of finding out Theorems and Problematical Constructions, with their Demonstrations by the steps of the Algebraic Resolution, is clearly exhibited.

Another Advertisement.

There is a Book preparing for the Press, intituled *SYNTAGMA MUSICÆ* ; in which the Eminent Author (John Birchenha Esq ;) treats of Musick Philosophically, Mathematically, and Practically. And because the Charge of bringing this Book to the Press will be very great, especially the several Cuts therein, with their Printing off, amounting by Computation to more than 500 l. besides other great Expenses for the Impression of the said Book, divers Persons, for the Encouragement of the said Author, have Advanced several Sums of Money ; who for every 20 s. so advanced are to receive one of the said Books fairly bound up ; the Author engaging himself under his Hand and Seal to deliver to each of the Subscribers, and Advancers of so much money, one of the said Books at or before the 24th of March 1674. In which Excellent Work there will be,

1. A Discovery of the Reason and Causes of Musical Sounds and Harmony : A compleat Scale of Musick (never before perfected :) The Proportions of all Consonant and Dissonant Sounds, useful in Musick, demonstrated by intire Numbers (which the Author saith hath not been done by any :) The differing Opinions of Musical Authors reconciled : Of Sounds gene-

rated, and diffused in their Medium : Of their difference to the Organ of Hearing ; together with their Reception there, and wonderful Effects : Of the Matter, Form, Quantity, and Quality of Musical Bodies or Sounds : That Musical Sounds are originally in the Radix or Unison ; and of their Fluxion out of it : Of the General and Special Kinds, Differences, Properties and Accidents of Sounds : Of the Truth and Falshood of Sounds.

2. Of the Principles of the Mathematical Part of Musick : Of the Whole, and Parts of the Scale of Musick : Of Sounds Equal and Unequal : Of the Numeration, Addition, Subtraction, Multiplication and Division of Musical Sounds : Of Musical Proportions, and their various Species's : What a Musical Body or Sound (Mathematically considered, viz. as Numerable,) is : Of Musical Medieties, sc. Arithmetical, Geometrical and Harmonical, together with 8 other Musical Medieties, of which no mention being made by any Musical Author : Of the Radix's of Musical Numbers, and that by their Powers all those Numbers, (and no other,) which demonstrate the Proportions of Sounds, do arise : Of Musick Diatonic, Chromatic, and Enharmonic : Of the Principles of a Musical Magnitude, what and how manifold they are, and how they are conjoyned : Of the Contact, Section, Congruity, Adscription of a Musical Body : Of the Commensurability thereof : In what respect a Musical Sound may be said to be Infinit, and how to bound that Infinity.

3. Of a Musical System, Character, Voice, or Key : Of the Transposition of Keys : Of the Mutation of Musical Voices : Of Musical Pauses and Periods : Of the Denomination of Notes : Of the Moods, and Intervals : Of pure and florid Counter-point : Of Figurat Musick : Of Fuges, Canons, Double-discant, Syncope : Of the Mensuration of Sounds (called Time) and the Reason thereof : Of Choral Musick, both Roman and English : Of the Rhythmical part of Musick : Of the Solmisation, and Reason thereof.

4. The Abstruse and Difficult Terms of this Science are explained : The unnecessary and mystical subtleties, into which the Causes both of the Theory and Practic of Musick were reduced to the great obscuring of this Art, are omitted : The Principles of Philosophy, Mathematicks, Grammar, Rhetorick and Poetry are applied to Musical Sounds, and illustrated by them : The Generation of such Sounds is discours'd of, and particularly demonstrated.

5. An easie way is by this Author invented for making Airy Tunes of all sorts by a certain Rule (which most men think impossible to be done,) and the Composing of 2, 3, 4, 5, 6 & 7 Parts ; which by the Learner may be performed in a few months ; viz. in two months he may exquisitely and with all the Elegancies of Musick compose two parts ; in three months, three Parts, and so forward ; as he affirms many persons of honor and worth have often experienced ; which otherwise cannot be done in so many years.

6. Whatsoever is grounded upon the several Hypotheses and Postulata in this Book, is clearly demonstrated by Tables, Diagrams, Systems, &c.

ERRATA. P. 5132. l. 31. r. these Veins.

LONDON, Printed for John Martyn, Printer to the R. Society, 1672.

PHILOSOPHICAL TRANSACTIONS.

Febr. 24. 16⁷²₇₃

The CONTENTS.

A New Experiment of Mr. Boyle concerning an Effect of the Varying Weight of the Atmosphere upon some Bodies in the water; suggesting a conjecture, that the very Alterations of the Air in point of Weight may have considerable operations even upon mens Sickness or Health. An extract of some Letters from Dr. John Wallis to the Publisher, concerning the Suspension of Quicksilver, well purged of Air, much higher than the ordinary Standard in the Torricellian Experiment. An Account of two Books: I. Observations Topographical, Moral, and Physiological, made in a Journey through part of the Low Countries, Germany, Italy, and France, &c. by John Ray, Fellow of the R. Society: whereunto is added, A brief Account of F. Willoughby Esq; his Voyage through a great part of Spain. II. Bernhardi Vareni M. D. Geographia Generalis, aucta & illustrata ab Isaaco Newtono, è Soc. Reg. An Index for the Transactions of the Year 1672.

A New Experiment of the Noble R. Boyle, concerning an Effect of the Varying Weight of the Atmosphere upon some Bodies in the Water; the Description whereof was presented A. 1671. to the perusal of the Right Honourable the Lord Brouncker; as the Experiment it self was since by the Author's favour shewn to the Publisher.

THough many things have by Ingenious men been already observed, as to the Power and Operations of the Atmosphere's Weight upon Liquors that are exposed to it in Torricellian Tubes (or other Vessels closed at one end, and near the top either empty or unfill'd with any visible Body;) yet men seem not to have much inquired what effects the very *Variation* of this weight of the Atmosphere may have on the Liquors which it presses, in other Vessels than such as Baroscopes and Pumps. And yet when I remember, how much of Air appears by our Engine to be invisibly harbour'd in the Pores not only of Water, but of the Blood, Serum, Urine, Gall, and other Juyces of the Humane Body, and that (as I have elsewhere experimentally shewn) the Pressure of the Atmosphere and the Spring of the Air work upon Liquors and on Bodies immers'd in those Liquors, as well as upon Solid ones immediately exposed to the Air, I am prone to suspect, that the very Alterations of the Atmosphere in point of Weight may, in some cases, have some not contemptible Operations even upon mens Sicknes or Health; as when the ambient Air, for Instance, grows suddenly very much lighter than 'twas before, or than 'twas wont to be, the spirituous and aerial particles, that are plentifully harbour'd in the mass of Blood, will naturally swell that Liquor, and so may distend the greater Vessels, and not a little alter the celerity and manner of the Circulation of the Blood by the Capillary Arteries and Veins. By which alteration that divers Changes may happen in the Body, will not seem improbable to those that know in general, how important a thing the manner of the Circulation of the Blood may be there, though

though as to its particular Effects I leave them to the speculation of Physicians; and shall only add, that to keep this Conjecture of mine (for I propose it as no other) from seeming as groundless as extravagant, I will annex an Experiment that you will not perhaps dislike, just as I find it register'd among some of my loose Papers.

I caused to be blown at the flame of a Lamp three small round Glas-bubbles about the bigness of Hazel-nuts, and furnish'd each of them with a short and slender stem, by whose means they were so nicely poised in water, that a very small change of Weight would make them either emerge, if they but lightly leaned on the bottom of the Vessel, or sink, if they floated on the top of the Water.

This being done at a time when the Atmosphere was of a convenient Weight, (and such a season is not ordinarily difficult to be chosen within some reasonable time to him that wants neither attention nor a good Baroscope) I put them in a wide-mouth'd Glas furnish'd with common Water, and leaving them in a quiet place, where yet they were frequently in my eye, and were suffer'd to continue many weeks (or some months,) I observed, as I expected, that sometimes they would be at the top of the Water, and remain there for divers days, or perhaps Weeks; and sometimes would fall to the Bottom, and after having continued there for some time (longer or shorter) they would again emerge. And though sometimes (especially if I removed the Vessel that contain'd them to a Southern Window,) they would rise to the Top or fall to the Bottom of the Water, according as the Air was hot or cold; yet 'twas not difficult to distinguish those motions from those produced by the varying Gravity of the Atmosphere. For when the Beams of the Sun, or heat of the Ambient Air, by rarifying the Air included in the Bubbles, made that Air drive out some of the Water, and consequently made the whole Bubble (consisting of Glas, Air and Water) somewhat lighter than a bulk of Water equal to it, though the bubble did necessarily swim as long as the included

Air was thus rarified, yet when the absence of the Sun, or any other cause made the Air loose its Adventitious warmth, there would ensue a Condensation of the Air again, and thereupon an Intrusion of more Water (to succeed the Air) into the Glass, and consequently a sinking of the Bubble, and this would commonly happen at night, if it did not happen sooner. But when 'twas upon the account of the Varying Weight of the Atmosphere that the Bubbles either rose or fell, it appear'd by the Baroscope, that the Atmosphere was so heavy or so light, that they ought to do so. Inasmuch that I divers times predicted, whether I should find the Mercury in the Baroscope high or low, by observing the situation and posture of the Bubbles; and consulting that Instrument, it verified my Conjectures. And though, whilst the Atmosphere was not too considerably either light or heavy, the Changes of the Air as to Heat or Cold, would (as I was saying) place the Bubbles sometimes at the top and sometimes at the bottom of the Water, within the compass of a day; yet if the Atmosphere were either very heavy or very light, the bubbles would continue at the bottom or at the top of the Water for many daies together in case the Atmosphere did not in all that time change its Gravity. And I remember, that I did, for curiosities sake, when the Quicksilver was high in the Baroscope, put the Glass two or three daies in a South-window about Noon (and for a good while after) and that in Sun-shining weather, and yet even then the Bubbles did not emerge, though it appear'd by a good sealed Weather-glass, which I kept in the same Window, that the ambient Air was much warmer than at other times, when I had observed the Bubbles to keep at the top of the Water.

N.B. 1. It being very difficult to poise several Bubbles precisely, as well one as another, I thought it not strange, that all the three Bubbles did not constantly (though for the most part they did) rise and fall together, but sometimes two of them, and now and then (though seldome) one alone would sink or emerge, when the change of the weight

weight of the Atmosphere was not considerable enough to operate sensibly upon the rest (and of such Instances I have had opportunity to observe one or two within these last three daies :) And therefore 'tis not amiss, to poise a greater number of Bubbles together, that, after tryal made of all, the fittest may be chosen. Which Advertisement will appear the more proper, because of what is to be added in the following Note.

2. I have observed it sometimes to happen, that a Bubble, that floated when 'twas first poised, would after a while subside without any manifest Cause, or if it were made to sink by such a cause, it would continue at the bottom of the Water, though that cause were removed : Which difficult Phœnomenon seeming to depend upon a kind of Imbibition made of certain Particles of an Aereal Nature by the Water, the consideration of it belongs to another place, not to this ; where it may suffice, that the experiment did sometimes actually answer expectation as that above-related did ; wherein my main drift was to shew, that since, as the Atmosphere is heavier or lighter, 'tis capable to work upon Bodies under Water so as to procure their sinking, or their emerſion ; the Air (though a fluid a thousand times lighter) must lean or press upon the Water it self, by whose intervention it produces these effects ; which confirms what I elsewhere teach, that the Atmosphere is incumbent as a heavy Body upon the Terraqueous Globe.

3. Besides the other Circumstances, upon whose account this Experiment may fail of success, the season of the Year, wherein 'tis tryed, may, for ought I know, be considerable. For which reason I shall here add this Advertisement, That I choose, but do not confine my self, to make my Tryals about the beginning of the Spring, as a time wherein notable alterations of the Air, as well as to Weight, as to other things, are the likeliest to be frequent.

So far this Experiment, which upon this occasion is likely to be improv'd unto a kind of Baroscope ; which, together with an Hygroſcope, may be expected ere long from the same hand.

*An Extract of Letters from Dr. John Wallis to the Publisher,
1672. Sept. 26. &c. concerning the Suspension of Quicksilver
well purged of Air, much higher than the ordinary Standard
in the Torricellian Experiment.*

S I R,

I Am not sorry to find, in your *Transactions* for the last Month, (which I have newly received,) that M. *Hugens*, an Ingenious and Inquisitive person, doth endeavour to give a Reason of that Odd *phænomenon* in the Torricellian Experiment (observ'd by my Lord *Brouncker*, and Mr. *Boyle*, many years since, in pursuance of an Order of the *R. Society* to that purpose,) of which I give an account in my Treatise *De Motu Cap. 14. Schol. prop. 13.* The *Phænomenon* is this:

See the Fig.

Whereas in the Torricellian Experiment, the Quicksilver contain'd in the Inverted Tube, how long soever, whose open orifice C. is immersed in stagnant Quicksilver, does usually fall down to the height of about 29. inches above the surface of the stagnant Quicksilver AB, and there remains suspended, as at I: If the Quicksilver be well cleans'd from Air, it has been found to stand top-full, much higher, even to the height of 75. inches (and how much higher it may stand, we cannot tell;) but upon the admission of the left Air, or a concussion of the Tube, it falls down to the usual standard.

Two Reasons I did there hint (though not perfectly satisfied in either:) The *one*, of my own, concerning the Spring of the Air, necessary to put Heavy bodies in motion, not impell'd by any other force: The *other*, of my L. *Brouncker*, that there might be in the Air yet a greater Weight or Pressure than is necessary for the height of 29 inches, in case there be nothing but the bare weight of Quicksilver to be supported.

I find, Monsieur *Hugens* to fall in with that of my Lord *Brouncker*, save that what we comprehend under the name of *Air*, he calls a *more subtile Matter*: which alters not the Case at all, but only the Name.

By

By *Air*, I find, Mr. Hobbes would sometimes (as in *Dialogus Physicus* p. 4.) have us understand a pure *Æther*, or (as his words are) *Aerem ab omni Terræ Aquæq; effluviis purum, qualis putatur esse Æther*; to which, I suppose, answers the *Materia subtilis* of Des. Cartes, and Mons. Hugen's his more subtle Matter than *Air*. On the other hand, M. Hugen's here, by *Air*, seems to understand that feculent matter arising from those the *Earths and Waters Effluvia*, which are intermingled with this subtle Matter. We mean by *Air*, the Aggregate of both these, or whatever else makes up that *Heterogeneous Fluid* wherein we breath, commonly called *Air*; the purer part of which is Mr. Hobbes's *Air*; and the feculent of it is Monsieur Hugen's *Air*.

And therefore, where I speak of *Vacuity* caus'd by the Torricellian Experiment, or such other ways, I do expressly caution (*De Motu* C. 14. and *Hobb. Heaut.* p. 152. and elsewhere,) not to be understood as affirming *Absolute vacuity* (which whether or no there be, or can be in nature, I list not to dispute;) but at least an Absence of that *Heterogeneous mixture which we call Air*, such as that is wherein we breath; without disputing against the *purus Æther* of Mr. Hobbes, or the *Materia subtilis* of Des. Cartes or M. Hugen's; as not necessary to the Inquiries in hand.

To the Pressure of this Purer matter (which they suppose so subtle, as to penetrate the Mercury, Marble, and Glass it self,) they adscribe the Suspension of the Quick-silver to so great an height. And my Lord Brouncker in particular, while that Piece of mine was under the Press, had a design (as He then signified to me) of prosecuting the Experiment (as Monsieur Hugen's does now advise,) to see if he could bring it to some Determination (of which I might there have given an account, if it could have been dispatcht time enough;) what were the utmost height at which it might be thus made to stand; thereby to determine the pressure of this Purer matter, as that of the Common Air is determin'd by the Torricellian Experiment. But his leisure not then serving, I only gave that brief account of his
Notion,

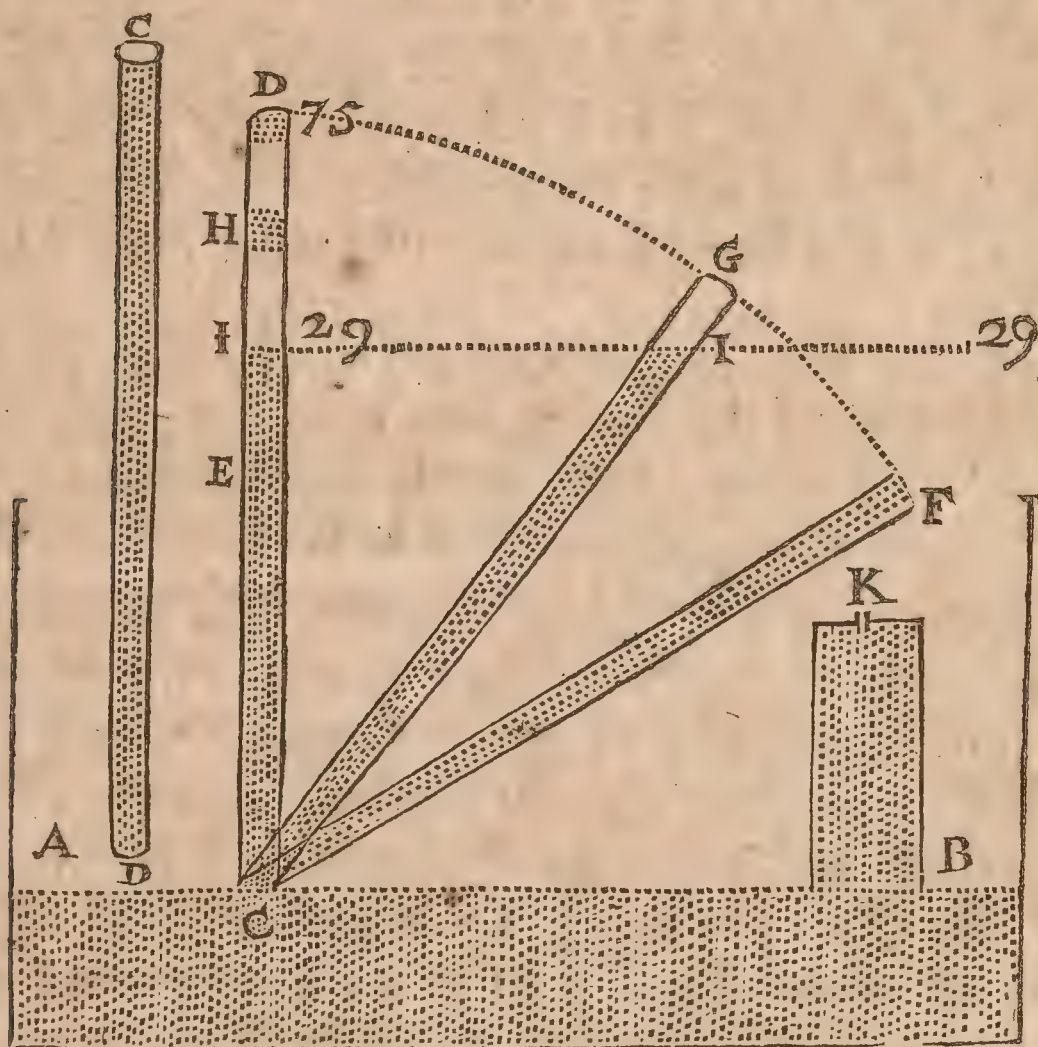
Notion, as it is there inserted : And, whether he have since had leisure, amidst a great press of other business, to pursue it, I am not certain.

Now, though I would not wholly exclude this, if such shall be found to be (but only suspend my Assent till it be evinced;) yet surely there must be somewhat more in it than that of this Subtile matter, to solve the *Phænomenon*, notwithstanding the two Experiments now alledged by *M. Hugen*s in favour of it. For, if this Matter be so subtile as to pass, through the top of the Glass, upon the Quicksilver (and consequently through the upper upon the nearer of the *two Marbles*,) as is acknowledged; (and without which it is no more able to precipitate the Quicksilver while impure, and when it is in part subsided, than when it is pure, and the Tube top full :) I do not see, why it should not balance it self (above and below) in the same manner as Common Air would do, if the Tube were pervious to it at both ends, and the Quicksilver, by the preponderance of its own weight, fall presently.

And the *Answer*, That, though the Glass be penetrated by it, yet not in so copious a manner as where no Glass is; doth not, to me, solve the difficulty : Because the same obstacle doth just in the same manner remain, when the Tube is in part emptied; and, when the Quicksilver is unpurged: the pores of the Glass not being, by either of those, made more open or more pervious. And if we suppose the Subtile matter by percolation to be strain'd through, with some difficulty, (as Air or Water would be through a cloth,) this might possibly cause the Quicksilver, when it does sink, to sink *gradually*; but not (as we see it,) *suddenly* to fall to the height of 29 Inches; as from D to I.

The Connexion or Cohæsion of the parts of Quicksilver, either each to other, or to the sides of the Glass, which *Mr. Hugen*s supposeth to require for their separation a greater force, than is in these percolated particles till they have room made for them to combine; seems to me the less considerable, because it is not so necessary to separate them from

from each other, since that they may un-separated slide down by the sides of the Glass; to which, it is well known, and visible to the eye, the Quicksilver is not at all apt to stick, but doth rather decline that contact; in like manner as we find Water not apt to Joyn with Oyle or Grease; though Water to Glass, and Quicksilver to Gold, do very readily apply themselves. So that there needs no such Force to dis joyn the Quicksilver from the Glass, whatever there may be for dis-joyning its parts one from another.



If therefore we should suppose the pressure of the *Grosser* Air downwards on AB (the surface of the stagnant Quicksilver,) and consequently, by means thereof, upwards at C, sufficient only to bear up that in the Tube to the height of I; but the super-added weight or pressure of the *Purer* Air to hold it up as high as D (75 inches or more,) while it is full, and the Quicksilver well cleans'd; as if so long it could not enter at D; but in case it be not so cleansed, or be already sunk to H, this *purer* Air would enter at D, and thrust

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thrust it down to I, counterballancing the pressure (at C) of the purer but not of the grosser Air (which I take to be the sum of the Cause assign'd by M. *Hugens* :) I am yet to seek, why it may not as well penetrate D at first to begin the Descent, as afterwards to pursue it; and, why not as well begin the Descent when the Quicksilver is well cleansed of Air, as when it is not so; and why also, if the pure Air do freely enter at D, it does not presently fall; or, if not freely, why, when it does fall, it falls suddenly and not leisurely from D to I; especially since so small a weight as DH of pure Air (for the grosser cannot enter,) is very inconsiderable; if not at all, or not freely, pressed by *that* incumbent on D; and the Adhesion not considerably less, by being separated only at the Top, while it yet continues to touch the sides.

I am apt therefore, as heretofore, to adscribe the Cause of this *Phænomenon* to the Spring that is in Air, and the want thereof in Quicksilver. For, that in Air there is a Spring or Elasticity, is now undoubted; but in Water, cleans'd of Air, though many Experiments have been attempted to that purpose, it has not yet been found that there is any: And I am apt to think the like of Quicksilver; though I do not know, that this has been yet so rigorously examin'd. Now supposing, that Matter, being at Rest, will so continue till it be put in motion by some Force; this force may be *either* that of *Percussion* from some Body already in motion (which is the Case, when the Quicksilver falls by shaking or striking the Tube;) or of *Pulsion*, from a contiguous Body beginning to move, as by the Expansion of some adjacent Spring (which is the Case, when the Springy parts of the Air, either left in unpurged, or re-admitted in the Quicksilver, by expanding themselves put the Quicksilver in motion;) or some *Conatus* or Endeavour of its own; such as is that of a Spring (from whatever cause it be, which I do not here inquire,) but has place only in Springy bodies; and therefore if Water and Quicksilver be not such, they will not on this account put themselves in motion.

Gravity

Gravity or Heaviness is, I know (if we knew what it were,) reputed to be such a *Conatus* or Pronity to move downwards, and so to put it self in motion: And the wonder at present is, why it does not so here. But if this, which we call *Gravity*, should chance to be not a Positive quality or *Conatus* originally of it self, but only the Effect of some Pulsion or Percussion from without, (which possibly may be the Case, and principally from the Spring of the Air about us;) then, while this Pulsion and Percussion is wanting (however obviated,) the Bodies, accounted Heavy, will not of themselves begin to fall: which seems to be the present Case.

And this is the more considerable, because we cannot (at least not yet) find, what is the Utmost height at which the Quicksilver thus accumulated will remain suspended; there having been (for ought I know) no height yet attempted, at which, if cleansed, it will not stand; and that of 75 inches, considering the weightiness of Quicksilver, is a very great one, being more than equivalent to 80 foot of water.

My Lord *Brouncker* doth a little alter the case, from what I take to be the Hypothesis of Monsieur *Hugens*. For he supposeth this purer part of the Air to be of like nature with the grosser part, (which I think M. *Hugens* doth not;) and, though finer than the rest, so as to penetrate Glass, which the grosser will not (there being in all sorts of grains, some greater than others, and which will not pass so fine a Sieve;) yet of a Springy nature, as the grosser parts are: Which therefore acts, not by its *Weight* only, but by its *Spring*; and therefore when once entred, though in a small proportion, acts as effectually, at its first entrance, as if the whole incumbent Air had admission; its Spring being of a like tensure with that of the outward Air; (as I have heretofore shewed *Cap. 14. De motu prop. 11, 12, 13:*) But M. *Hugens's* more Subtile matter than Air though he must allow it *Weight* (for else its entrance would be nothing to the purpose,) yet whether he allow it a Spring, I cannot tell; nor doth he inform us. And when he says, this more Subtile

matter than Air doth without difficulty penetrate Glas, Water, Quicksilver, and all other bodies, which we find impenetrable to Air; I know not whether he mean, without *any* difficulty (as the words seem to import,) or (as I conjecture by what follows) without *great* difficulty, though with *some*.

But his Lordship (if I mistake not) though he allow his (Springy) Subtile matter to penetrate Glas, yet not without difficulty; and, till it have some room made (as HD) wherein it may recollect it self, cannot exert its Spring, and therefore not while top-full of cleansed Quicksilver; but, so soon as some room is made for it: Whereas, if the Quicksilver be not purged of Air, that little Air remaining doth by its Spring begin the motion.

He thinks it also not improbable (and if it so prove, it will be a good confirmation of this *Hypothesis*,) that a large but low Tube of Glas (shorter than 29 inches) may stand top-full of Quicksilver, though with a small hole in the Top, as at K; at lest, if immersed in Water, in case Air be too Subtile for our Mechanicks.

He might also, suitably enough to his own Hypothesis, have so explained himself, as to allow his more Subtile parts of common Air to penetrate Quicksilver, but not Glas; and therefore, in case of room for it at HD, it might through the Stagnant Quicksilver, and that at C, pass upwards to HD, and there exert its Spring.

I shall forbear to dispute against this Hypothesis for the present; because I think it more proper to examine by Experiment (which I think hath not yet been done,) whether well-purged Quicksilver may not be made to stand higher than CI, the ordinary standard, suppose at CH, with a void space about it, as HD. For the issue of this Experiment (amongst others to be after mentioned,) seems very proper for determining of this doubt; which therefore I am not willing to pre-judge. There is yet another way of explicating the same Hypothesis, without allowing this Subtile matter to pierce the Glas; which is this:

Our

Our common Air being an aggregate of very Heterogeneous parts, we may well suppose some of them to be Springy, and others not to be so. The Springy parts we may conceive to be so many consistent Bodies, like small hairs or springy threads wrapped up in different forms and variously intangled, and so as to form many vacuities capable of admitting (whatsoever other parts of the Air may be supposed to be) some Fluid matter, which may insinuate into those vacuities, (as water in a bundle of Bushes,) without disturbing the Texture of those Springy parts; and which may press as a *Weight*, but not as a *Spring*, (of which distinction see *Cap. 14. De motu, Schol. prop 11. & Schol. prop. 13. pag. 729, 730, 732, 733.*)

Now if, in the Torricellian Tube, there be a quantity of such Springy matter, the Spring hereof will be of equal strength with that of External Air, (and therefore able to counterballance it, though its weight be much less,) because admitted with such a tensure, (*ibid. prop. 12. 13.*) But if only an Un-springy Fluid (which presseth but as a *Weight* not as a *Spring*,) and this defended by the glass-Tube from any other pressure, save that of its own weight; it will still be too weak to force its own way, till its single weight be equivalent to that with which it is to encounter; which is, not onely the Springy part of the Air, but also that Fluid Un-springy part; which though (because Fluid) it would give way to a Springy body pressing through it; yet not to this Fluid, like it self, and destitute of such a Spring; and is therefore able to keep it up to a much greater height than it could do if un-cleansed of Springy Air: So long at least as till some Springy body be admitted, or some concussion, equivalent to it, put it in motion; but being once in motion, it will so continue (as a Bullet impell'd by Gun-powder, or an Arrow out of a Bow,) till stopped by some Positive force equivalent.

I do not deny, but that this explication may be subject to some Difficulties and Exceptions; but I think, fewer than that of allowing the Glass penetrable by this Subtile matter.

But,

But the best way to settle this business, being some suitable Experiments; I should recommend (because I am not so well accommodated for this purpose,) these, or some of these, Experiments, to those of the *Royal Society*, who are in that kind better provided than I.

1. (That hinted by my Lord *Brouncker*,) Whether a large low Tube, of less height than the common Standard (of about 29 Inches *English*, or 27 Inches *French*,) might be made to stand top-full of Quicksilver, though a small hole be left open at the Top; at least under Water? I am apt to think, that it will rather sink slowly and with a hissing noise, than fall suddenly and silently.

2. Whether of two polished Marbles or metalline Plates, the lower will be found to stick to the upper, in the exhausted Receiver, longer than is accountable for from the ordinary Counter-balance in the Torricellian Experiment. For though Monsieur *Hugens* now, and Mr. *Boyle* (if my memory do not much fail me) have long since intimated this from his own Experience; yet I judge the Experiment worth repeating. And if it be (as I suppose it may) found to succeed, I should think it may proceed from a want of a Spring or Elastick power between the Plates to force them asunder; and in particular (since with this it hath been tryed) that Spirit of Wine is not a Springy body.

3. Whether a Siphon of unequal Legs will be made to run, in an exhausted Receiver, with Water or Quicksilver, at a greater height than is accountable for; which though Monsieur *Hugens* have tryed it, I think it worth repeating in this *Society*. This when it doth succeed, I take to proceed from the Spring of that little remaining Air in the Receiver not quite emptied.

4. (Which seems of a like nature with the former,) Whether a Tube of greater length than 29 Inches, but so immerg'd as to be less than so much above the level, as CE, may not, if filled with well cleansed Quicksilver, be gently lifted up with the Quicksilver in it, not only to I (as when it is unpurged) but to H or D, higher than the usual Standard.

5. (which

5. (Which is equivalent, but more easily administred,) Whether if such a Tube, so filled, be at first so inclined (as CF) that its height above AB be less than 29 Inches, may not be leisurely and gently erected, so as to remain full, not only to the height of I, but of G or D?

6. Whether cleansed Quicksilver will, in the open Air, run in a Siphon higher than 29 Inches?

7. If not in the Air, whether it will so run, if the lower Leg open into well-cleansed Water?

8. (Which I do principally recommend;) In a Tube so filled with cleansed Quicksilver, as to stand top-full at a greater height than the usual Standard, as CD; in case some part be forced out, not by admission of Air but by Jogging the Tube, (I suppose as much as HD,) and a stop then made: Whether the rest CH (at a greater height than I, the usual Standard,) may be made so to stand of it self, notwithstanding the voidance of HD? For by this Experiment alone, if it succeed, it will appear, that it is not onely want of room for the Subtile matter to recollect it self, which hinders the suspended Quicksilver from falling; but rather (unless some probable cause can be found,) the want of a Spring to put it in motion. If it will not succeed, I should rather think, the Springy Air doth make its way through the Quicksilver than through the Glass.

9. Whether cleansed Quicksilver will remain suspended in an inverted Tube (at least a short one, and with a small Orifice,) though its Orifice C be no immerg'd in Quicksilver, but either in the open Air, or at least in Water?

10. If so; then whether it will do the like, if, a little being forced out, there be some void room left at the Top, at HD?

These are nice Experiments, and of some difficulty; but if carefully administred, may be of good use in our search after the true nature of *Gravity*: Which may possibly have a greater connexion with the Spring of the Air, than men are aware of; since on the presence or absence thereof doth mainly depend the falling or not falling of
Bodies.

Bodies accounted Heavy. But I am not willing, by interposing my own Conjectures, to pre-judge the Experiments.

An Account of Two Books.

- I. *Observations Topographical, Moral and Physiological made in a Journey through part of the Low-Countries, Germany, Italy and France, by John Ray, Fellow of the R. Society: Whereunto is added a Brief Account of F. Wilmoughby Esq; his Voyage through a great part of Spain. London, printed for J. Martyn, Printer to the R. Society, at the Bell in St. Pauls Churchyard, 1673. in 8°.*

THis Curious and very Instructive *Itinerary* may well serve as a Pattern for Travelling with that improvement and advantage, as ought to be aimed at by all discreet Travellers; as containing whatever is remarkable both for Persons and Things in those places, which the Ingenious and Inquisitive Author together with his good Company travelled through. Let his Reader be a States-man, an Ecclesiastick, a Philosopher, an Artist, a Trades-man, a Father of a Family, an Husband-man, they will all of them find matter in this Book very proper for their respective Genius, Professions and Callings. Here is described the Climat, Government, Revenues, Laws, Customs, Manners, Tempers, Abilities, Studies, Arts, Trades, and Natural Productions of the Countries spoken of; and besides, divers Fabulous relations and ungrounded fancies refuted and rectified.

We shall only hint in this place the principal Heads of such particulars, as belong to the purpose of *these* Tracts; in reference to which is to be noted what the Author observes,

1. Of the several Constitutions of Climats, and the difference, he found, between the Temperature of the *Air* on two opposite sides of some Mountains.

2. Of *Waters*, as the most considerable Rivers and the Fishes bred therein; Of Springs, (the Original of which he discusseth,) ebbing and flowing Wells, *spaw*-waters (particularly

(particularly those about *Liege*,) Baths (especially those of *Aken* in Germany, and *Apona* in Italy;) of Fountains boiling, and others yielding *Petroleum* near *Montpelier*, &c.

3. Of the *Earth*, and its Productions and Inhabitants: In which Head there occur;

j. Some Instances of Changes made in the Earth, as of Land gained from the Sea, and Mountains considerably diminished in height.

ij. Of *Minerals*, and particularly of Mines of Precious Stones, as Amethysts, Emeralds, Topazes, Jaspers, Granates, &c. observ'd in the Voyage into *Spain*; of petrified Shells, which Subjects he handles both largely and ingeniously.

iiij. Of *Plants*, more especially remarked by our Traveller in all the places where he passed, witness the particular *Catalogue* of them, annexed at the end of this Book.

iiij. Of *Animals*, as Insects, Fishes, Birds, &c. concerning which the Author gives us good hopes of a more particular Account in the *History of Animals*, prepared by that Worthy Gentleman Mr. *Francis Willoughby*, lately deceased to the unspeakable grief of those that knew him.

iiij. Of the *Inhabitants* of the several Countries he was in: Where he describes their Abilities, Inclinations, Manners, Studies, Exercises, Arts, Trades; giving a very particular description of the *Italians* and *Spaniards*, and observing also some Peculiarities in People of several Countries, as, that some breed excellent Painters, Sculptors and Architects; some abound in Idiots and Delirious persons above others; some are stored with Men and Women afflicted with swelled throats, &c. Taking also notice of the Academies and Colleges, and the Men eminent in them for Learning and Knowledge, as *Loven*, *Leiden*, *Heidelberg*, *Basel*, *Nuremberg*, *Altorf*, *Padua*, *Bononia*, *Valence*, &c. Likewise of Libraries; of Cabinets or Repositories; of Natural Curiosities, particularly at *Delft*, *Heidelberg*, *Milan*, *Florence*, *Naples*, &c. Of notable *Ædifices* and curious Structures, as the extraordinary Steeple at *Strasburg* and the Church of *St. Peter* in *Rome*; of Whispering Places, Aqueducts and

Ventiducts; of remarkable Armories; of Artificial Contrivances, Instruments, Vessels, Engines; as Locks to keep up water of any River for the use of Navigation; an Engine to raise Water with a chain of Buckets; a Vessel at *Heidelberg* holding 600 Hogsheads; the *Spanish* Plough for sowing Corn at equal distances, and one grain in a hole: Of Arts, Trades, Practices, Manufactures, as the Art of imitating China-dishes at *Milan*, of polishing Jasper, of making Mosaic Work and the composition of the Cement for it; of the practice of making Salt by the Sun, upon the Coast of the Mediterranean; the catching of Sword-fishes, Whales, Tortoises; of Coral-fishing; the making of Silks and Velvets; the Dying of Wool of an Incarnation colour, with a kind of Moss growing in *Malta*; a peculiar fewel made at *Leige* of balls of Clay and small beaten Coals; the Art of blanching Wax, making Venice-Sope, Verdigreece, Oyl-olive; of preparing and pickling of Capers; of drying Grapes for Raisins; of making Confection of Alkermes; of making Sugar, Chocolata &c.

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London, Printed for J. Martyn printer to the Royal Society, 1672.

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PHILOSOPHICAL
Transactions:

GIVING SOME

A C C O M P T

OF THE

Present Undertakings, Studies and Labours

OF THE

I N G E N I O U S

I N M A N Y

Considerable Parts

OF THE

W O R L D.

VOL. VIII.

For the Year MDC LXXIII.

L O N D O N,

Printed by T.R. for *John Martyn*, Printer to the Royal Society;
at the Bell in St. Pauls Church-Yard.



I

Tab. II

II

Trans. N^o 92.

Observat^{es} aliquot hⁱrotundi cum stellis
in recta linea cum ipso et vetere Satellite.

1671 Dec. 16. 24. Mer.

* 24 * 16 * 24 * 16

1672. Jan. 23.

* * * * *

1672. Jan. 25.

* * * *

Occ.

Or.

1672. Dec. 13. 17.

* 13 * 17 * 13 * 17

Digressiones Comit^{is} ext^{imi} à h^o ad
occidentem à d. 6. ad 19. Feb. 1673.



19 17 16 15 14 13 12 11 10 * 8 7 6 *

Sept.

Observat^{es} novi Intimi Comit^{is} hⁱ.

1. novus Intimus. 2. vetus medius.

1672 Dec. 23. h. 7. Mer.



Dec. 30.



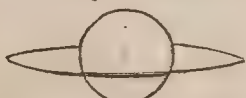
1673. Jan. 10.



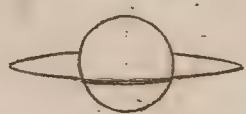
Jan. 15.



Jan. 17.



Jan. 19.



Occ.

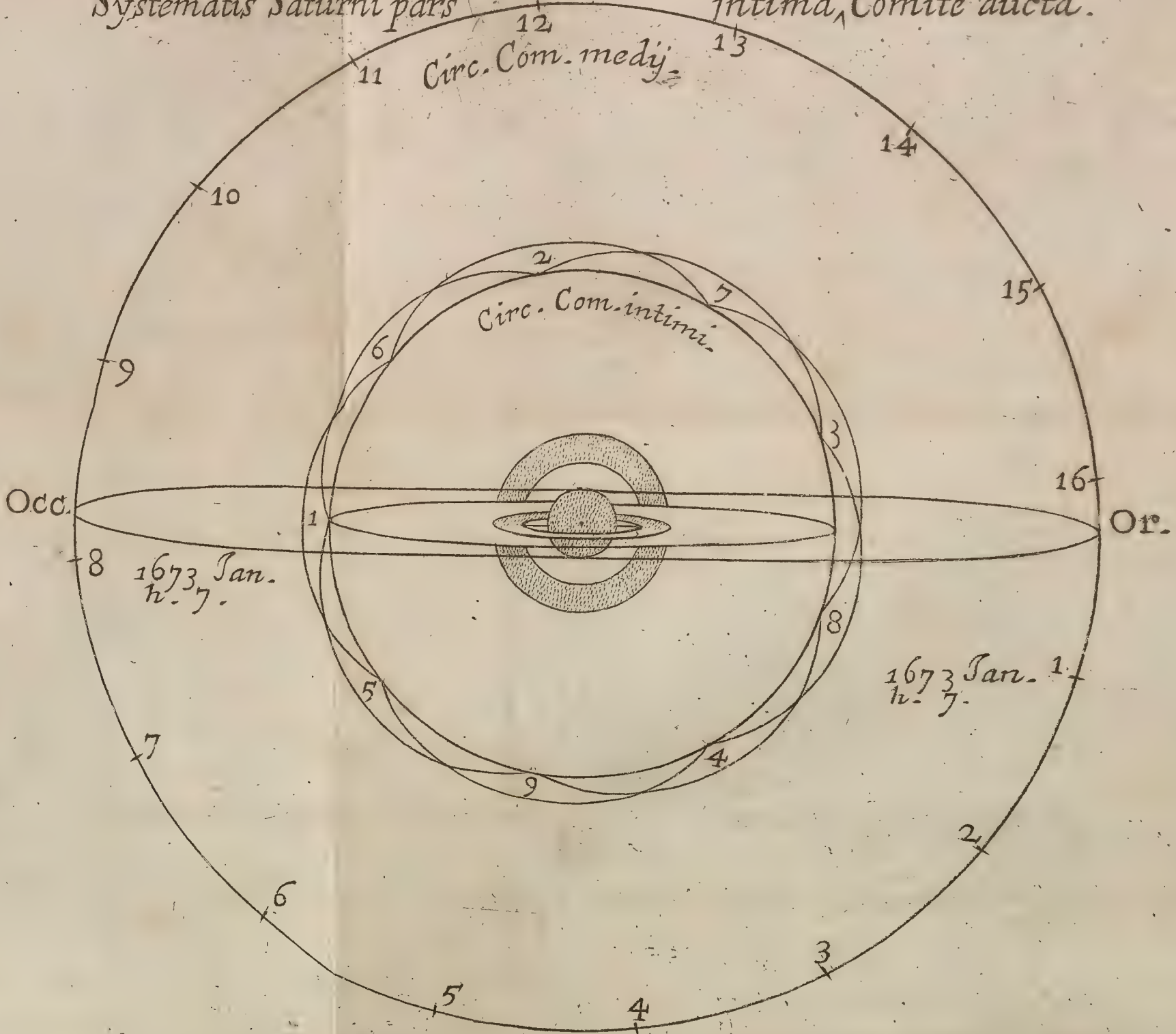
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Sept.

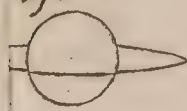
Systematis Saturni pars

III

intima, Comite aucta.





*Intimi Comitio 5ⁱ.**2. vetus medius.**Mer.**Dec. 30.*1
*

2

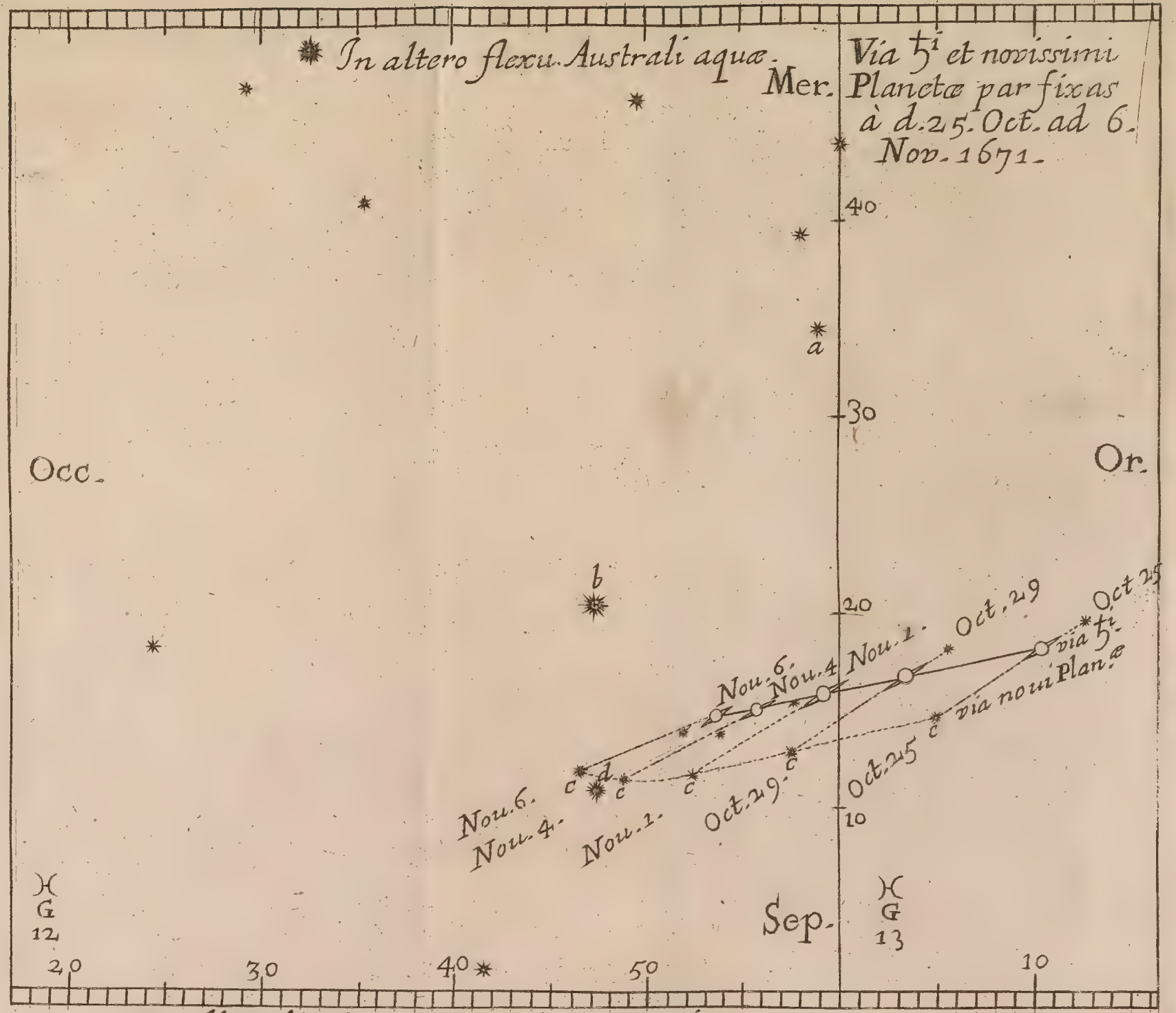
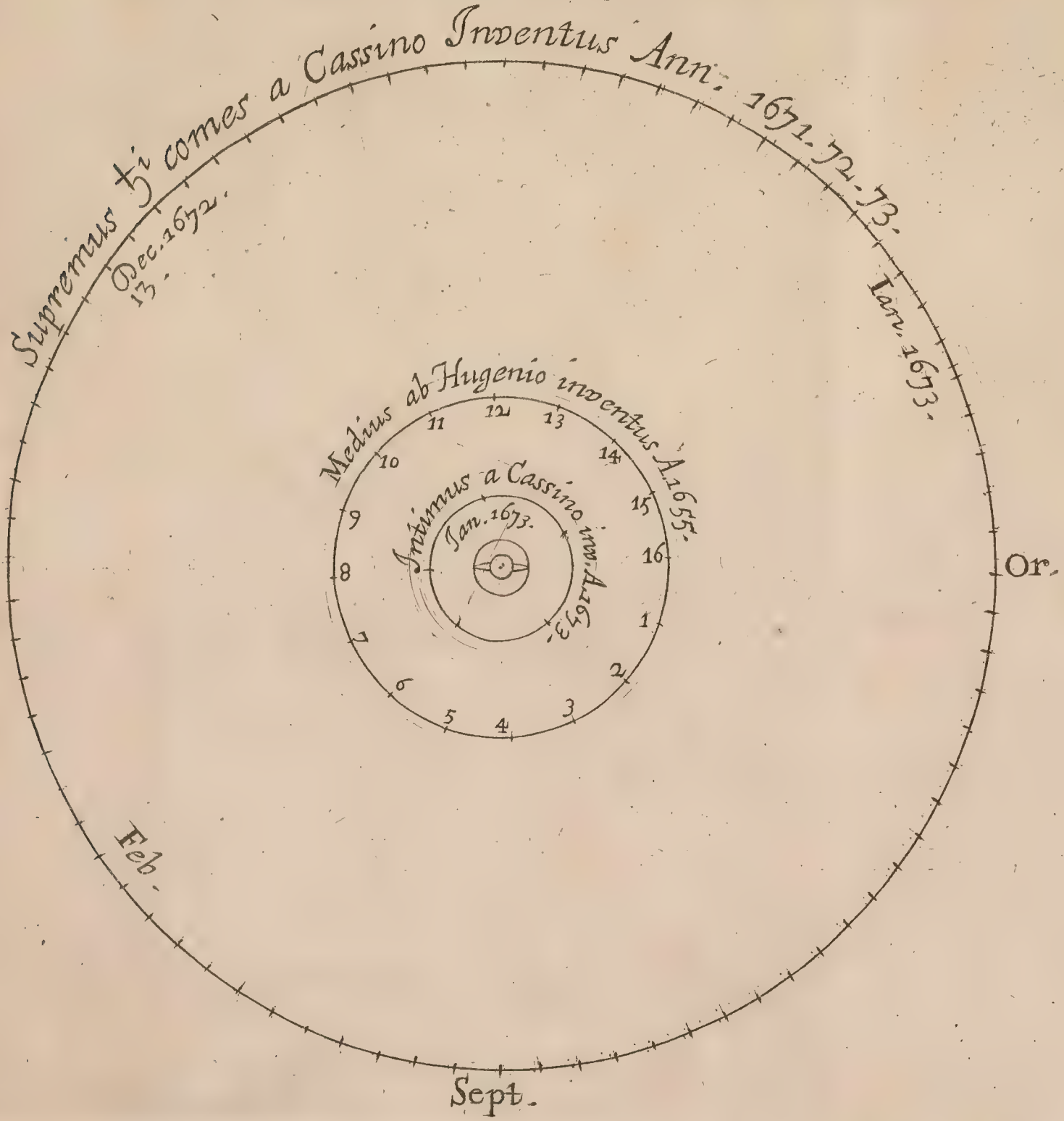
*Jan. 10.*

Tab. I.

II

Trans. N^o 92.

Planetae noui circa $\frac{1}{2}$ ex Reg^o Observat^{io} detecti.
cum vetere intermedio.



Parall^l Eclipticae ad g. 2. latit Aust^{is}



PHILOSOPHICAL TRANSACTIONS.

March 25. 1673.

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The P R E F A C E.

THE Learned St. *Hierom* was formerly our Advocat in celebrating the Travels and hardy Adventures of Philosophers to acquire knowledge, and in commemorating the respectful Addresses and Veneration, which great and wise men offer'd to Philosophers. This he performs with most affectionat ardor; and these Respects are agreeable to the Dictates of Right Reason, of Good Nature, and of the Good Manners of the Civil Gentiles. Also our famous *Cowley* came close to our Concernments, both in his Poetical inspirations, and in his sober Prose. He vindicates the excellency and distributes the main parts of Experimental Philosophy. And thus far we have obtain'd, in our Defence, Authentique zeal, well-grounded Raptures, Ancient and Modern Suffrage; on both sides accomplish't with the politest Learning and soundest Judgments.

Now, for a Caution, to prevent an unhappy Obstruction, that it may not interrupt the Generous in their pursuit of Reviving and Promoting the Ingenuous Arts, I shall here enquire a little the Cause of their Decay in degenerating Ages. And the Roman *Satyrist*, whose style was too often polluted by the profligate Luxury of his days, hath yet reserv'd, for our occasions, a clean, elegant and brief Declamation, (perhaps one of the best Remains of Antiquity,) since pertinent and argute Declamations had a great name in the Schools of Rome and of old Greece.

Petron.

*Tum ille (Eumolpus Encolpio,) Pecunia, inquit, cupiditas hæc Tropica * instituit. Priscis enim temporibus, cum adhuc nulla virtus placeret, vigeabant Artes Ingenuæ; summumque certamen inter homines erat, ne quid profuturum seculis diu lateret. Itaque hæc*

* I. e. Umbras rerum atque imagines tantum, & simulacra rerum inania; surdo figurarum discrimine. Sic *Jan. Douss.* V. *Plin.* l. 35. c. 11. Conversiones, inquit *Erhardus*, & mutationes. Sic *Dan. Heinsius*; Quis Deus *Tropica* hæc induxit, aut quæ est hæc commutatio?

har-

harculâ * *omnium herbarum succos Democritus expressit ; & ne Lapidum Virgultorumque vis lateret, etatem inter Experimenta consumpsit. Eudoxus quidem in cacumine excelsissimi montis consenuit, ut Astrorum Cæliq; motus deprehenderet : Et Chrysippus, ut ad Inventionem sufficeret, ter helleboro animum deterfit. Verum, ut ad Plastas converterar, Lysippum statuae unius lineamenti inherentem inopia extinxit ; & Myron, qui ferè hominum animas ferarumque, ære comprehenderat, non invenit heredem. At nos vino scortisque demersi, ne paratas quidem Artes audemus cognoscere ; sed, accusatores Antiquitatis, vitia tantum docemus & discimus. Ubi est Dialectica ? Ubi Astronomia ? Ubi Sapientie consultissima via ? Quis unquam venit in Templum, & votum fecit, si ad Eloquentiam pervenisset ? quis, si Philosophie fontem invenisset ? Ac ne bonam quidem mentem, aut bonam valetudinem petunt ; sed statim, antequam limen Capitolii tangerent, alius donum promittit, si propinquam divitem extulerit ; alius, si thesaurum effoderit ; alius, si ad trecenta H S. salvus pervenerit. — — Nolite ergo mirari, si Pictura defecit, cum omnibus Diis Hominibusque formosior videatur massa Auri, quam quicquid Apelles Phidiæve, Græculi delirantes, fecerunt.*

By comparing this collapsed state of the noblest Sciences, we may see the peculiar happiness of this present Age, in which there are in all parts of the Learned World so many excellent persons of Lustre and Honour, of eminent Authority, great Power, and ample Fortunes, who do generously contribute the influence of their Countenance, many their own Personal Assistance, and some their Treasures, to recover and adorn the Antient Arts, and to supply Extraordinary Aids and Accommodations.

And this Glory is principally to be ascribed to our Most Gracious King, the Founder of the *Royal Society*, whose propitious Patronage doth cherish so many learned Votaries and curious Artificers in all his Kingdoms, and as far as his Dominions do extend ; and whose great Example doth invite and encourage

* Erhard. lege arculâ. Nemo fuit, qui daret significatum ignotiori vocabulo. Fuere qui emendarent. At ego ex *Vitruvio* ostendam, Arcam esse Machinam, quâ marinus fluctus à portu reprimatur ; & inde dimittit. *Arcula*, machina quâ humor aliunde exprimitur. Idem *Schicklerat*. in ep. crit. & *Barthius*. Vid. *Vitruv.* l. 5. c. 12. Quibusdam deest hæc vox : Cæterum nullum exemplar habent.

to many forrein *Virtuosi* of great fame and solid worth, to afford considerable Assistance towards the Propagation of Philosophical Arts, and the Advancement of knowledg. Of which many pregnant Instances and manifest Matters of Fact do bear evidence, as they are with faithfulness, but without artifice or elaboratness, registred in these un-polish'd Volumes.

A Discovery of two New Planets about Saturn, made in the Royal Parisian Observatory by Signor Cassini, Fellow of both the Royal Societys, of England and France; English't out of French.

I.

A Discovery of 10 small Fixt Stars, and of one New Planet, first.

ABout the end of *October* 1671. Saturn pass'd close by Four small Fix't Stars, visible only by a Telescope, within the *sinus* of the Water of *Aquarius*, which *Rheita* once took for New Satellits of Jupiter, calling them *Urban-octavians*; but which *Hevelius* (who called them *Vladislavians*) shew'd to be some of the common Fix't Stars, that may every day be seen by a Telescope any where in the Heavens.

This Passage of Saturn gave us occasion to discover in the same place, within the space of 10 minuts, by a Telescope of 17 feet, made by *Campani*, Eleven other smaller Stars, one of which, by its particular motion, shew'd it self to be a true Planet: which we found by comparing it not only to Saturn and his Ordinary Satellit, discovered 1655 by Mr. *Hugens*, but also to other Fix't Stars, and particularly to three, marked *a, b, d*, in the First Table, where, to avoid a long explication of our first Observations, we have describ'd the way of Saturn, and that of the New Planet, alwayes marked *c*, beginning from *October* 25. unto *Novemb.* 6. We have added to it the Ordinary Satellit, without any particular mark, because he is easie to be known, being in these observations always next to Saturn. The distances are represented in their just proportions; but to make Saturn more remarkable in the Table, he is represented twice bigger than he should be in proportion to the distances *.

* Note, that in Tab. I. fig. 1. the divisions mark'd in the greatest Circle do denote the days of the 3 months, nominat'd within that circle.

These Observations shew a motion of this New Planet that is very manifest in respect of the Fix'd Stars, but less sensible in respect of Saturn. Yet it appears, that from *Octob. 25.* unto *Novemb. 1.* his distance from Saturn increased Westward, and from that time unto *Novemb. 6.* it diminished; so that his greatest digression from Saturn hapned in the beginning of *Novemb.* and was found to be of 8 minuts, or of $10\frac{1}{2}$ diameters of Saturns Ring. Whence it was consequent, *that*, if this Planet were a Satellit of Saturn, he must be unto the end of *Septemher* in the inferior part of his Circle, and from the beginning of *November* in the superior part; and *that* his revolution about Saturn was of a long duration, since for 12 days together he not only remain'd on the same Occidental side of Saturn, but there was also little change of apparent distance between him and Saturn. The greatest digression of this Planet was *treble* to that of the *ordinary* Satellit, and this enabled us to judge the Time of his revolution to be *quintuple*, applying to the Satellits that proportion, which Kepler hath noted in the Principal Planets, between the periodical Times and their Distances. But there was one circumstance, which made us doubt, whether it were a *Satellit* or a *Principal Planet*, which was; That in the last observations we took notice, that he had a *little* Southern latitude in respect to the Line of the wings of Saturn, which we had not observed in the *first*, when he was nearest to Saturn; which happens not to the other Satellit, which hath always the *more* latitude, the *nearer* he is to Saturn; yet it might well be, that the Circle of this Planet might have some declination from the Circle of the other Satellit, as it comes to pass in the Principal planets, the Circles of which are inclined to one another. However this difficulty made us suspend our Judgment until we could make such a number of observations, as might suffice for a more precise determination.

A pursuit of the New Planet.

See Tab.
I. Fig. II.

BUT the Sky being over-cast for many days, did interrupt our observations. However we saw Saturn *Novemb.* 12. 16. 17. 19. 23; and observed, that he was yet more approach'd to the Fixed stars, *b, d,* but we could find no foot-step at all of the New Planet. And we had little hopes left us of finding him again by the same Telescope, by which he had appeared very small towards the end. Notwithstanding, whilst we expected a greater Telescope, we were not wanting, during some intervals of fair weather, to seek, if we might not again meet with some such Star about Saturn.

See Tab.
II. Fig. I.

We found then *Decemb.* 16. of the same year, that Saturn had retaken his round figure, and that on the East of him there was a small star, far distant, in a straight line to Saturn, and to his ordinary Satellit, which was Oriental also, but little distant from Saturn. And *Decemb.* 24. we saw this Satellit in the West, and a Star, Oriental likewise, less distant from Saturn than that we had seen the 16th. But the weather did not permit us to verifie, whether it was the same. At length, *Januar.* 18. 23, 25, of the year 1672. we saw on the West of Saturn, sometimes one star, sometimes many, far distant, almost in a direct line to his ordinary Satellit; which made us hope to see another time the New Planet towards his greatest Western digression; but these Observations were the last, which the weather suffered us to make, before Saturn did abscond himself in the beams of the Sun.

We represent in the second *Table Fig. I.* some of these interrupted Observations, though they be but made by the estimate of the Eye, and we then were not able to make out what kind of Stars they were.

After my return from a voyage of *Provence*, having brought with me from *Marseilles*, in the beginning of *Novemb.* 1672. an excellent Telescope of 35 foot, which *Campani* had made by order of his Majesty; we set it up in the Royal Observatory, directing it to Saturn, as soon as the weather would give leave,

to seek for the New Planet. In the first observations, made Decemb. 13 and 17, we perceived an Occidental Star, remote from Saturn, which in both these observations had a Southern latitude in respect to the line of his wings; but in the first it was further distant from Saturn than in the second: So that, if this was the same Star, as I *supposed* it to be, not having been able to *make it out*, by comparing it with Fixed ones, there being at that time none within the Aperture of the Telescope; it moved towards Saturn on the East, and consequently (supposing it to be his Satellit) it was in the superior part of his Circle.

See Tab.
II. Fig. I.

III.

A Discovery of another New Planet.

WE could not see Saturn again but the 23th of December, and then in the presence of Messieurs *Hugens, Picard, Mariotte, Romer*, and others of the *R. Academy of the Sciences*, we found a small Star westward of Saturn, between him and his Ordinary Satellit, which was on the West also, almost at a double distance. And at that time we had no other reason to suppose it to be different from the former, but that it had no latitude at all in respect of the Line of Saturn's wings.

See Tab.
II. Fig. II.

The weather did not suffer us to see Saturn again till the 30th of December; and then we saw a little Star, on the East of him, without any latitude between him and his Ordinary Satellit, which had passed also to the East of him. This observation, compared with the precedent, kept us yet in suspense, because we know not, *whether* this, which seem'd to us the same with that of the foregoing observation, had passed from one side of Saturn to the other, by one only motion slower than that of the ordinary Satellit, and consequently by a little arch of a greater Circle; or whether, during this interval of time, it had made one or more turns by a lesser Circle; which was much more accomodable to the position, in which it had appeared *without* Latitude in both observations; as ordinarily it befalls the Satellits, when they are in their greatest digressions.

But we being not to rely upon these two Observations alone,

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See Tab.
II. Fig. II.

we were very impatient for an opportunity of giving our selves more satisfaction about this *phenomenon*. The heavens were not favourable to us till the 10th of *Januar*. 1673; and then this little Star appear'd to have return'd almost to the same position in respect of Saturn, and his ordinary Satellit, where it had been *Decemb*. 23. That which made us wonder, was, to have found three times consecutively this small Star between Saturn and his Ordinary Satellit, always in a distance almost equal from one and the other. But our admiration ceased at the fourth Observation, made *Januar*. 15, in which the Ordinary Satellit was Oriental, and the New one Occidental, as it had been in the precedent, but a little nearer to Saturn. We had that evening time enough attentively to observe this Planet for a whole hour together, during which we perceived, it approached to Saturn on the West, and consequently was in the superior part of his Circle: which did fully confirm us in the supposition we were inclin'd to, that it was an *Interior Satellit*. Thus the pursuit of another Satellit, which we knew to be further distant from Saturn, and to have a longer period, made us discover this, which is nearer to it, and whose period is shorter.

IV.

An Hypothesis of the Motion of the Interior Satellit.

Then it was, that comparing the Observations together, we began to find the Rule of the Motion of the New Interior Satellit. For the two last shew'd us, that in 5 days he had made more than a whole revolution. The first observation compar'd with the third made us Judge, that in 18 days he had made a Number of revolutions, almost whole ones, which certainly were four; each of them was of $4\frac{1}{2}$ days: So that between the 10th and 15th it might be, that there had been one revolution of $4\frac{1}{2}$ days, or two revolutions of $2\frac{1}{4}$ days each.

But the combination of the first with the second made us conclude the period of $2\frac{1}{4}$ days. We therefore judged by these observations; *That* this last Planet finishes his revolution about Saturn in $4\frac{1}{2}$ days; *that* the Semidiameter of this Circle is of three

three Semidiameters and a fourth of Saturn's Ring; and *that* he was towards his greatest Occidental digression the 23th of December, and *Januar.* 1. about 7 a clock in the evening.

Upon these grounds, after the fourth Observation, we made an *Ephemerid* of this Planet, as it is represented in *Tab. II. Fig. III*; where we added that of the old Satellit; that so by the Observations where both are to be nigh to Saturn, men might be able to distinguish them: And this *Ephemerid* hath serv'd us since, untill the Occultation of Saturn; without having found any other difference in the following Observations, but that, as for the nearest Planet, the Return to the same place, after one revolution of $4\frac{1}{2}$ days, is made one hour later; so that one circuit is finish'd in 4 days and 13 hours. We have also learned by the following observations, that when the *Interior* Satellit is much distant from his great digressions, he hath some Southern latitude in respect to the Line of the wings in the Upper semicircle, and some Northern latitude in the *Inferior*; as hath also the Old Satellit, which hath more of it in proportion to the diameter of his Circle.

See Tab.
II. Fig. III.

The Observations of this Planet were made not only with the Telescope of *Campani*, but also with one of *Divini* of 36 foot; and with one of the same length of *Mons. Borelli*, who is a Member of the *R. Academy* of the Sciences.

V.

A Return to the Observations of the New Exterior Satellit of Saturn.

OUR application to observe the Planet nearest to Saturn, in the small time we had at evenings, by reason of his proximity to the Sun-beams, had diverted us from the other more remote Planet. But *February* 6. we began to see him again, and the weather favour'd us well enough to observe him almost all the days following untill the 20th of *February*, except the 9th and 18th.

See Tab.
II. Fig. I.

He was conveniently seen by *Campani's* Telescope of 17 foot, by which the first discovery of it had been made; and by another of 20 foot, made by *Le-bas*, with which *Mr. Picard*

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observed him also unceasingly, and sometimes in the Company of Mr. *Hugens* and Mr. *Mariotte*. The first observations of the distances were made by an Estimate of the Eye, comparing the *exterior* Satellit to Saturn and to the other Satellits. The last were made by the measure of the Time between the passage of the Planet, and that of the Center of Saturn.

This New Planet did more and more remove from Saturn till the 9th of *February*, when we measur'd the difference between his passage and that of the Center of Saturn to be 30" of an hour, which give at least 10 diameters of Saturn; but on the 20th, he was already too near the beams of the Sun, to measure his distance; which yet by estimat was judged greater than it had been the 19th. The diverse scituations of this Planet, in respect of Saturn and of the Line of the wings, between *Febr. 6.* and 19, are represented on the lower part of *Tab. II. Fig. I.*

By the apparent swiftness of his Motion during the first days, 'tis casie to see, that this Planet had been seen in Conjunction with Saturn *Febr. 3*; and by his motion on the West it appears, that he was in the inferior part of his Circle: And because during this time of 17 days he removed more and more from Saturn, 'tis certain that he remained in the same quadrant of the inferior Occidental Circle above 17 days, and that his whole Revolution is more than 68 days.

He was these last days at a distance almost equal to that which he had about the end of *Octob. 1671*; so that in 480 days or thereabout he made a certain number of Intire revolutions, which can be no more than 7; since each of them is without question of more than 68 days. If you should count 7 of them, each would be 68½ days; if you count 6, each would be 80 days; if you count but 5, each would be 96 days. But this last supposition can by no means be made to agree with the two Observations of *Decemb. 1672*, and the first doth not agree so well with them as the second.

The proportion of the apparent distances in the observations of *February*, which are the best, would make us estimate each of his Revolutions between 80 and 96 days; but the proportion of the greatest digression of 1671, compared with that

that of the two other Satellites, together with their periods, agrees better with 80 days. Therefore in the *Ephemerid* which we give of one Revolution, we follow this, untill we get a more precise determination, which requires a greater number of Observations, that cannot be begun but towards the next summer Solstice, by reason of the Oblique Ascension of Saturn, and his Southern latitude, which will keep him long in the beams of the Sun.

An Extract of a Letter, Written by David von der Becke, a German Philosopher and Physitian at Minden, to Doctor Langelott, Chief Physitian to his Highness the Duke of Holstein now Regent, concerning the Principles and Causes of the Volatilisation of Salt of Tartar and other Fixed Salts: Printed at Hamburg, 1672.

THis Learned Author, having exploded the Useless and Empty terms of *Faculties, Qualities, &c.* and recommended the Investigation of Nature by *Experiments* guided by *Reason*; commends, for the practice of this latter, that excellent Naturalist and Physitian, Dr. Joel Langelott, in that Discourse of his, touching the great Use of *Digestion, Fermentation, and Grinding* in Chemistry; of which a Breviate was given in Numb. 87. of these Tracts. Out of which Discourse he chuseth, before all, to elucidate that part, which treats of the *Volatilisation* of Salt of Tartar, as a Subject, which he had likewise considered and inquired into.

Having therefore, (as he affirms, and as will appear by the sequel,) formerly taken pains in the like Fermentation of Tartar for the *Volatilizing the Fixt Salt* thereof, he endeavours here to declare his thoughts about the *Causes* of his undertaking that labour, and of the *Manner* how that Volatilisation is performed. In the doing of which he labours to shew, *first*, The *Causes* of the *Fixation* of the Salt of Tartar: *Secondly*, The *Reasons* of the *Volatilisation*: And *lastly*, what degree of *Volatility* the Salt of Tartar hath acquired in that Fermentation made with its own Ferment.

As to the *first*, he begins with blaming those, that divide

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Salts into *Fixt* and *Volatil*, forasmuch as, in his opinion, that Division is unknown to Nature, there being not to be formally found in any Body before Calcination any Fixt Salt, such as the Alcalisate Salt of Tartar and other Fixt Salts are, produced by Calcination. He therefore informs us, That Salts that are Volatile before Incineration, are by the action of the Fire, as the Efficient, so colliquated among themselves and with the Earthy particles, as to be fixed thereby. For the clearing of which, he presupposeth with some others, that there are Two kinds of Salts, an *Alcali* and an *Acid*, as the genuin Instruments of Nature, by which the several Kinds and Seeds of things are put forth, and which every where are employed in the Germination of Plants, and the first Conceptions of Animals, and in all the beginnings of Fermentations. These two Salts he affirms to be *both* Volatile, and therefore easily resolvable by the supervening Salt of the Air: since it appears, that all Vegetables, especially Aromaticks, if they be any considerable time exposed to the Air, loose their Salts; and that Wood in particular, by the action of the Air, consuming the Volatil Salt, doth in time quite moulder away. Whilst therefore these Salts are loosen'd and set at liberty by the fire, (for else they would not act,) they begin to operate on one another; the Volatil *Acid*, whilst it works upon the volatil *Alcali*, fixeth it, and they are colliquated together. Which operation of Nature being well observed, it will be manifest, that that received Axiome, *Things Volatil are fixed by those that are Fixt, and things Fixt rendred volatil by those that are Volatil*, is false. Now, that Volatil Salts are consumed by the Air, and colliquated by Fire, is so notorious, that Common people are wont to sink in water such Timber as they would preserve from putrefaction, thereby to keep it from Air, and to harden it to a great degree for strong supports of buildings. Hence also they slightly burn the ends of Timber to be set in the ground, that so by the Fusion made by Fire the Volatil Salts, which by the accession of the moisture of the Earth would easily be consumed to the corruption of the Timber, may catch and fix one an other. For which reason also, namely the fusion of the same volatil Salts, Ship-wrights are wont to burn the lowermost

ermost part of Ships, that lyes under water. And to use a very common Instance, *Soot*; 'tis known, that whilst the Wood is burning, the smoak ascends, wherein the two Volatil Salts are contain'd, that coagulate one another into Soot, which two Salts may thence easily be separated and made visible; and these Volatil Salts, constituting the smoak and the soot, rise so long, untill the wood be quite reduced to Ashes, in which the remaining Volatil Salts are colligated to a Fixt Salt, easily to be wash't out by water. These two Volatil Salts therefore afford the matter, of which the Fixt Salt is made by means of the Fire: Whence 'tis evident, that we must, (as really we do,) obtain so much the more Fixt Salt, the more Volatil Salt there was before Incineration in the Mixt Body; as also, why out of herbs, freshly burnt to ashes, we get a greater quantity of Fixt Salt, than when they have been dryed up; because the Air by its operation (which is somewhat advanced by the moisture in the plant it self, dissolving the Salts,) hath robbed them of the greatest part of their Volatil Salts. Upon which same account, wood decayed and moulder'd away contains almost no Fixt Salt, as it hath also lost almost all its weight.

Having thus shew'd, that before Incineration there is found in Mixt bodies no *Fixt* Alcalifat Salt at all, and how the Volatil Salts by calcination are brought to fusion and so fixed; the Author, further to make out the Fixation of such Volatil Salts, takes notice of the *Mixture of Earthy parts* in such bodies; some of which, when those two Volatil Salts, thus open'd by the Fire, act on one another, are con-coagulated with them. Which he conceives to be the case, when the said two Salts being concreted in the Kidneys, they by their asperity wound their sanguineous Vessels (whence the Nephritique pain,) and so coagulate together with them the extravasated Blood, which makes the Stone of the Kidneys reddish; as the Stone of the Bladder is whitish from the mucous substance of the bladder, therefore given it by nature, lest the sharp Urine by working upon its membrans should cause pain, being coagulated together. And so he observes, that the Stones concreted in the Bladder of Gall, tast bitter by reason of the Gall that is coagulated.

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This Earth then, when by the Fire 'tis intimately united with the Salts, and has been in a manner vitrified with them, keeps them so close together, that they can no more rise and fly away than birds fastn'd to a rock; those Salts being rendred so fix, that by a gentle fire they are not so much as at all moved; by a strong one, brought to fusion; and, united with a considerable quantity of Earthy particles, by an extream degree of heat vitrified. So if you mix fixt Salt of Tartar with Cinnaber of Antimony, or with Quicksilver, all the Quicksilver, though a very ponderous body, will pass into the Retort, but the Salt of Tartar by reason of its Earth remain at the bottom of the Vessel. Whence he esteems it evident, that the Fixt Alcalies, especially that of Tartar, cannot, by reason of the colligation of the Earthy parts, penetrate into bodies to be dissolved, nor consequently remove the inmost seeds of Diseases.

Now, in the *second place*, though the *Volatilizing* such Fixt Salts, and particularly that of Tartar, have been hitherto found a very difficult work; yet doth our Author conceive it would be very easie, if we took but Nature for our Guide, and but separated from Salt of Tartar the *Fixing Earth*, that has been proved to be mixed with it. For the doing of which he refers to the prescript of Dr. *Langelot*, requiring that the Fixt Salt of Tartar be mixed with its genuin Ferment, *viz.* crude Tartar, or (if in the Fermentation you have a mind to see the grape-like bubbles) Creme of Tartar, and so expos'd to fermentation. In which commixture of Ferment he would have this especially observ'd, that it be mixed to the very degree of *Saturation*, and untill the fermenting agitation and the motion of the saline particles do cease, as a sign, that there is not any particle of the fixt salt of Tartar left un-conjoined with the acid particles of the Crude Tartar or its Creme, nor any acid part of the crude Tartar not Saturated by the Fixt Salt. Which being observed, the Distillation will, the action of the Salin particles being thus stopp'd, the more securely be done. Mean time, that only the Acid particles of the crude Tartar are laid hold on by the Fixt Salt, and not the Alcalisat, he promises a proof of hereafter.

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But since the main Question is about the *New Volatilisation* of the Fixed Salts, the Author is altogether persuaded, that in his Fermentation of Tartar 'tis not chiefly the very *Fixed Alkali of Tartar* that is again volatilised, but rather the added Ferment, which is the *Crude Tartar*. For in this crude Tartar, though there be no fix't Salt in it, (which he hath asserted generally of all Mixts,) yet the volatil Alcalisate particles of the Tartar are detained by the Volatil Acids of the same, commixed with it to the very degree of saturation; whence they are fixed, forasmuch as these two when conjoined do fix one another, when separated, become again Volatil. Which manner of Fixation he calls *Natural*, being shew'd us by Nature; as that, which is made by the Colliquation of the Earth by Fire, *Artificial*, because only perform'd by Art; upon the account of which, Volatil Salts are detained no otherwise, than Birds tyed to a rock are restrained from flying away.

Now, though indeed the Fixed *Alkali* of Tartar is in this fermentation freed from that Earth, to which by the fusion of the fire it was intimately united; yet notwithstanding this, 'tis fixed again, *saieth he*, by the *Acid* of the Tartareous Ferment. For the clearer proof of which, he makes use of the Urinous Spirit of *Sal Armoniac*, in which there are two Volatil Salts, an Urinous, and Acid. These two Salts, *saieth he*, though they be Volatil when separate, yet when united they detain one another, emulating as 'twere the nature of Fixt ones, since they are neither dissolved in the Air, nor emit any odour, as true Volatils are wont to do. Now to obtain out of this Salt the Urinous volatil Spirit, there is requisite a Separation of these two Salts; for this bond being dissolved, the Urinous immediately riseth. To obtain which, water is powred upon the *Sal Armoniac* (because Salts act not but when dissolved,) and then there is added a Fixt *Sal Alkali*, which whilst 'tis Joined with the Acid portion of the *Sal Armoniac*, (for the more fixed Acid is sooner united with the fixed Alkali, than with the Volatil;) the volatil *Urinous* part quickly deserts its fellow *Acid*, and being conjoined with the water, yields a most volatil and piercing spirit, which, though the *Sal Armoniac* before the
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commixture of the Fixt Salt was quite inodorous, yet now after the addition thereof strikes the nose most violently, and that even when put from the fire; insomuch that if you do not, after the mixing of the Fixt Salt, very accurately close your vessel, you will afterwards find no Spirits at all. Wherefore as in this Example of *Sal Armoniac*, the Fixt salt added, freeth the *Alcalifat* portion of the Salts; so in this Fermentation of Tartar, the Tartar calcined to blackness, or the Fixt salt of Tartar, freeth the *Alcalifat* part of the crude Tartar from the Acid parts. For, *saith he*, in the crude Tartar or its putrified Creme there are, as in *Sal Armoniac*, two Volatil Salts, an Alkali and Acid, from the colliquation of which (as hath been said) the Fixt salt results: since 'tis notorious, that in the fermentation of wine the *Acid* particles do coagulate the superabounding *Alcalifat* with the Terrestrial ones to the very degree of saturation, and so by their increased weight take place in the lower part of the vessels.

If therefore to this Tartar, pregnant with Salts, crude, or depurated by a solution in water, you add a calcined Tartar, or, which is the same, Salt of Tartar it self, immediately this Fixed salt will lay hold on the Acid portion of the crude Tartar, and, as in the *Sal Armoniac*, so here, free the volatil *Alcalifat*; from which conflict and action of the salt on one another, grape-like bubbles will arise. And this injection of calcin'd Tartar must be continued, untill all Fermentation do cease, that is, to the very degree of Saturation: which unless it be well observed, many inconveniences will obstruct the Operator. But this volatil *Alkali*, being by means of the calcined Tartar freed from its *Acid*, (like the Urinous of the *Sal Armoniac*,) will presently fly away. Wherefore if this volatil Spirit could forthwith be received, it would afford a real volatil Salt of Tartar, especially if by art it were freed from its phlegme (which makes it a fluid Spirit,) and, without the addition of any extraneous thing, coagulated into Salt. But this cannot be, *saith he*, seeing that, before all the fermentation and motion of the saline particles shall have ceased, this mixture cannot be put into the Cucurbit, because it would break the vessel; nor can the Fixt salt be added to the dissolved crude

crude Tartar all at once, but at several times, because else all the fermented part would quickly get out at the edges of the Cucurbit: Now then, since every time there is, by the addition of the Fixt Salt, so much of the Volatil Acid freed out of the crude Tartar, as much as there is added of Fixt Salt, and that presently flies away, it certainly follows, That, if by injections several times repeated you come at last to the point of Saturation, there will remain no volatil Alcalifat salt at all of the crude Tartar.

Since therefore there is no hopes of obtaining the Volatil Salt from crude Tartar this way, we must endeavour to get it by an addition of Tartar calcined, or Fixt Salt; and how this is to be done, hath been already intimated, *viz.* by the separation of the Earthy parts. For as the volatil Alcalifat particles, upon a very vehement colliquation of the fire, are, by an intimat union with the Earthy parts, kept from ascending; so also, when freed from these Terrestrial fetters, they are restored to their former freedom and volatility. And this Separation of the Earth we obtain by this Fermentation of the Tartar; for, in the same moment that the Acid portion of the crude Tartar is conjoined with the Tartar's Fixt Salt, to set the Volatil Alkali of the crude Tartar at liberty; there is also made a precipitation of that insipid Earth, which by the extreme degree of Fire was united with the Salt of Tartar, and had fixed it before.

But to expose this Fixing Earth to the view of all, I shall alledge the Example of Vitriolat Tartar, known to the very Apprentices of Apothecaries. In this operation, whilst the Spirit of Vitriol is affused to the dissolv'd Salt of Tartar or its Oyl made *per deliquium*, you may observe a very great Effervescence, during which and the action of the Acid of the Vitriol upon the Alkali of the Tartar, there is precipitated an Earth (for the separation of all which, care is to be had of the degree of Saturation between the Spirit of Vitriol and the Salt of Tartar,) which afterwards may be sever'd by filtration. Now that this Earth is precipitated not out of the Spirit of Vitriol, but rather the Salt of Tartar, none, versed in these things, can be ignorant of. This precipitated Earth some call the Magi-

stery of Vitriolat Tartar, and very impertinently prefer it often in their prescriptions to the true Vitriolat Tartar it self. This Earth indeed hath a Saline taste ; but these Salts, as is usual in all Precipitations, did only adhere to the matter precipitated, and may by a repeated ablution be easily separated ; which done, there remains nothing but an utterly insipid Earth, which can have no other virtue but that of exsiccation. Wherefore after the self same manner, whilst the Acid part of the crude Tartar is united with the Alcalisate of the Salt of Tartar, the Earth also of the Fixt Salt of Tartar in the said fermentation will be precipitated.

The greatest difficulty being thus dispatch't, our Author proceeds in the *third* place to a lesser, yet remaining, which is ; That the *Acid* part, by means of which the Earth was precipitated, detains the volatil Alcalisat part, and fixeth it anew ; so that his Volatil Salt of Tartar hath hitherto acquired no greater degree of volatility, than crude *Sal Armoniac* or the Flowers thereof are known to have. For these, though they are made up of volatil parts, yet they diffuse no odour before the separation of the volatil parts ; they also endure the Air ; which no volatil salts, truly such, will do : Wherefore they cannot yet be reckon'd among Volatils, strictly so call'd.

Now then, to give to this Volatil Alkali of Tartar the last and highest degree of Volatilisation, the Author esteems it necessary, there should be made a New addition of Fixt Salt of Tartar, which in the same manner, as before it had freed the Alcalisat part of *crude Tartar* from its Acid, must here also take from the manifest Acid of crude Tartar the Alcalisat part of the *Fixt Salt of Tartar*, already freed from Earth ; whereby this Alcalisat part of the Salt of Tartar, truly volatilised, being joined to the water (which was before added for the free action of the Salts,) will constitute a most Volatil Spirit, which he saith is coagulable, without addition, into volatil crystals, having the perfect taste of Tartar.

So far this Author of the Volatilisation of Fix't Alkalies, and particularly of Tartar ; concerning which 'tis wish't by some of our Philosophical Chymists here, that this Author would please to make good proof, 1. That all Salts are Volatil before Cal-

cination,

cination, and consequently, that in Mixt Bodies there is no Fixt Alcalifat salt at all, that is originally such, but that all Volatil Salts are fixed by Calcination, by means of which the Earthy parts in them commixed are concoagulated with them; and that upon this ground the Volatilisation of Fixed Salts may be easily perform'd by only separating from them that Fixing Earth, said to be commixed with them. 2. That in the Volatilisation of Salt of Tartar, perform'd by the Fermentation of Dr. Langelot, 'tis not chiefly the Fixed Alkali of Tartar, that is again volatilised, but rather the Crude Tartar added for a ferment. 3. That in *Sal Armoniac* there are only those two Salts, which he calls an Urinous and Acid, and both Volatil; whereas 'tis well known, that there is a Sea-salt in it, which contains many parts, that will for a long while endure a strong fire.

Some Observations touching the Nature of Snow, presented to the R. Society by Dr. Nehemiah Grew.

IF those great Philosophers, *Aristotle* and *Cartesius*, and others, of their Followers, who have written of *Meteors*, and amongst them of *Snow*, have not yet given us a full account hereof; it will not be needless to enquire further of it. He that will do this, will do it best, not by the pursuit of his phancy in a Chair, but with his Eyes abroad; where if we use them well fixed, and with good Caution, and this in a thin, calm and still Snow, we may by degrees observe;

First, with Monsieur *Des Cartes*, and Mr. *Hook*, that many parts hereof are of a regular figure; for the most part, as it were, so many little Rowells or Stars of 6 points; being perfect and transparent Ice, as any we see upon a pool or vessel of water. Upon each of these 6 points, are set other collateral points, & those always at the same angles, as are the main points themselves.

Next, amongst these irregular figures, though many of them are large and fair; yet, from these taking our first *Item*, many others, alike regular, but far less, may likewise be discover'd.

Again, amongst these not only regular, but entire parts of Snow, looking still more warily, we shall perceive, that there are divers others, indeed irregular, yet chiefly but the broken points, parcels and fragments of the regular ones.

Lastly, that, besides the broken parts, there are some others, which seem to have lost their regularity, not so much in being broken, as by various winds, first gently thaw'd, and then froze into little irregular clumpers again.

From whence the true notion and External nature of Snow seemeth to appear, *viz.* That not only some few parts of Snow, but, Originally, the whole body of it or of a Snowy cloud, is an infinite mass of Icicles regularly figur'd; not one particle thereof, I say, *Originally*, not one of so many millions, being indeterminate or irregular: That is to say, a Cloud of Vapours being gathered into drops, the said drops forthwith descend; upon which descent, meeting with a soft freezing wind, or at least passing through a Colder Region of Air, each drop is immediately froze into an Icicle, shooting it self forth into several points or *stiriae* on each hand from-ward its Center: But still continuing their descent, and meeting with some sprinkling and intermixed gales of warmer air, or in their continual motion and wastage to and fro touching upon each other; some are a little thaw'd, blunted, frosted, clumper'd, others broken, but the most hanked and clung in several parcels together, which we call Flakes of snow.

It being known what *Snow* is, we understand, why, though it seem to be soft, yet 'tis truly hard; because true Ice, the inseparable property whereof is, to be hard; seeming only to be soft, because upon the first touch of the finger upon any of its sharp edges or points, they instantly thaw; or otherwise they would pierce our fingers as so many Lancets.

Why again, though Snow be true Ice, and so an hard and dense body, yet very light; because of the extream thinness of each Icicle in comparison of its breadth. For so Gold, which though of all bodies the most ponderous, yet being beaten into leaves, rides upon the least breath of Air; and so in all other bodies, where there is but little matter contained within large dimensions, and possibly in no other Case.

Also how it is *white*, not because hard; for there are many soft bodies white; but because consistent of parts all of them singly transparent, but being mixed together, appear white; as the parts of Froth, Glass, Ice, and other Transparent bodies, whether soft or hard.

Thus

Thus much for the *External* nature of Snow ; let us next a little enquire into its *Essential* nature.

Now if we would make a judgment of this, I think we may best do it by considering, what the general *Figure* of Snow is, and comparing the same with such regular figures as we see in divers other bodies, in that where we see the like configurations, we may believe there is the like subject *wherein*, or the like efficient *whereby*, both those and these are made.

As for the Figure of Snow, 'tis generally one, *viz.* that which is above described : Rarely of different ones, which may be reduced chiefly to two generals, Circulars and Hexagonals, either simple or compounded together. More rarely, either to be seen of more than 6 points ; but if so, then not of 8 or 10, but 12. Or in single shoots, as so many short slender Cylinders, like those of Nitre. Or by one of these shoots, as the Axle-tree, and touching upon the Centre of a pair of pointed Icicles, Joined together as the two wheels. Or the same hexagonal figure, and of the same usual breadth ; but continued in thickness or profundity, like the stone, which, as I remember, *Boetius* calls *Astroites*. All these, I say, are rare, the first described being the General figure.

As for the Configurations of other bodies, we shall find, that there are divers which have some a less, others a more near resemblance hereunto. *Nitre* is formed, as is commonly known, into long Cylindrical shoots, as also all *Lixivial Salts* for the most part ; resembling, though not perfectly, the several points of each Starry Icicle of Snow. *Salt of Harts horn*, *Sal Armoniac*, and some other volatil Salts, besides their main and longer shoots, have others, shorter branched out from them ; resembling as those the main, so these the Collateral points of Snow. But the Icicles of *Urine* are still more near : For, in *Salt of Harts-horn*, although the Collateral shoots stand at acute Angles with the main, yet not by pairs at equal height : And in *Sal Armoniac*, although they stand diametrically opposite, or at equal height ; yet withall at right, not acute, angles : Whereas in the Icicles of *Urine* they stand at equal height, and at acute angles both ; in both, like those of snow. And it is observable, that the configuration of *Feathers* is likewise the same.

same. The reason whereof is, because Fowls having no organs for evacuation of Urine, the Urinous parts of their blood are evacuated by the habit or skin, where they produce and nourish feathers.

From hence it should seem, That every drop of Rain aforesaid, containing in it self some Spirituous particles (as from the height, to which they are advanced, the prolific virtue of Rain, and its easie tendency to putrefaction above other water, is argued they do,) and meeting with others in their descent, of a Saline, and that partly nitrous, but chiefly urinous, or of an acido-salinous nature; the said Spirituous parts are apprehended by them, and with those the watery, and so the whole drop is fixed; yet not into any indifferent and irregular shape, depriving the spirituous parts of their motion in an instant; but according to the energy of the Spirituous, as the Pencil, and the specifick nature or determinate possibility of the saline parts as the Ruler, 'tis thus figur'd into a little Star. These things somewhat further consider'd and clear'd, may add a little to that great deal of light, which the *Honourable Mr. Boyle* hath given to the nature of Cold, the Air, and the Bodies therein contained, in his excellent Discourses hereof.

A Confirmation, given by Dr. Wallis, of what was deliver'd in Numb. 90. about the Strange Freezing in Somersetshire.

THE Strange Frost (or Freezing rather) you give an account of to have hapned in *Somersetshire* in *December* last (though I remember not the day) was the like with us at *Oxford*. It was rather a Raining of Ice, or at least Rain Freezing as it fell; which made strange Icicles hanging on Trees, and a strange noise by the rattling of them upon the Bows motion by the wind: But not so much as at the places you mention in *Somersetshire*. Yet more in the Country about us (as from several Relators I have heard,) than with us here. And the great Warmth soon after was also with us; insomuch that not only Blossoms, but (as was then certainly affirm'd, though I was not so curious as to get a sight of any,) green Apples on divers trees; particularly in the parish of *Holy-well*.

An Account of two Books.

I. *TRACTS*, written by the Honourable Robert Boyle, containing *New Experiments touching the Relation betwixt Flame and Air, and about Explofions: An Hydrostatical Discourse, occasioned by some Objections of Dr. Henry More, &c; To which is annex't an Hydrostatical Letter, about a Way of Weighing water in water: New Experiments, of the Positive or Relative Levity of Bodies under water; of the Air's Spring on Bodies under water; and about the Differing Pressure of Heavy Solids and Fluids.* London, 1672. in 8°.

IN the first of the *Tracts*, which contains the *New Experiments* about the *Relation betwixt Flame and Air*, the Noble Author, after he had mentioned some of the chief difficulties, both in *making* and *judging* of these Experiments, and occurred also to some thoughts, that might arise in the Reader, about his not ascribing in these Narratives so absolute and equal a necessity of the *Air* to the production and conservation of all *Flames*, as divers Men have concluded from his former Experiments; after this, *I say*, he divides this Discourse into three parts. The *first* delivers Nine Experiments concerning the Difficulty of producing Flame without Air; tryed especially upon *Brimstone*, *Gunpowder*, and *Aurum fulminans*, in *vacuo Boyliano*. The *second*, contains Six Experiments touching the Difficulty of preserving Flame without Air in the said *vacuum*; tried upon Mineral bodies already kindled, in order to receive some new Informations about the *Diversities* and some other *phenomena* of Flame, and the various degrees, wherein the Air is necessary or helpful to them. The *third*, furnishes five Experiments of the strangely difficult *Propagation* of *Actual* Flame without the assisting presence of the Air; tried upon *Spunk*, *Camphire*, *Gunpowder*; which last, though fired it self, yet would not fire the contiguous grains in this *Vacuum*, except in one tryal, wherein kindled coals being employed, it is guessed, that the Coals acting strongly at the same time on the whole extent of the powder that was next to them (in the absence of the

the Air,) each grain was in that case a kind of a little *Granado*, and the heap of them being uniformly enough acted on by the fire, they were made to go off, as to fence, all at once, as if there had been but a contemporary *Explosion* made of them all together by the action of the external fire, rather than any true *Accension* made by the flaming grains of the unkindled ones.

To this first Tract our Author adds; 1. Some New Experiments about the Relation betwixt *Air* and the *Flamma Vitalis* or Vital Principle of Animals; In the first of which Experiments are compar'd the Duration of the Life of an Animal, and of the Flame of Spirit of wine, included in a close vessel: In the second, is compar'd the Duration of the Life of a Bird with the lasting of a burning Candle or Coal in *Vacuo Boyliano*: In the third, is observ'd what happen'd to the Light of Glowworms in the Exhausted Receiver: In the fourth, the foregoing Tryal is varied and improv'd: In the fifth, the former Inquiry is still further prosecuted: In the sixth and last, 'tis examin'd whether Animals be heavier dead or alive. 2. An Attempt to produce *Living* creatures; and another made upon *Gnats*, in the same *vacuum*.

In the *Second* Tract the Author considering, that some of the Assertors of the *Flamma Vitalis* do explicate many of the motions of Animals, especially those perform'd in the Muscles by the *Explosions* made of certain juices of the Body, when they come to mingle with each other; as also, that the Maintainers of this *Hypothesis* are found to insist on no other instances in favour of it than the going off of Gunpowder: He was induced to suspect, they were not yet provided with better Examples, and therefore thinks, it will not be lookt upon as useless, if, without offering to determine any thing about the Truth of the Opinion, he supply the Embracers of it with some Examples of Explosions made by the bare mingling of Liquors; as one made with the *Spirits* of Nitre and Wine; another, with Oyl of *Vitriol* and Oyl of *Turpentine*; a third, by two Bodies actually *Cold*.

The *third* Tract is a Polemical Discourse, answering some Objections pompously proposed by Dr. H. More in his *Enchiridium*

dium Metaphysicum against some Explications of New Experiments, made by our Author, and relating to the Gravitation and Pressure of Fluids. Our Noble Philosopher than in his Vindication still asserts, and with great clearness maintains; That, supposing the World to have been at first made and to be continually preserv'd by Gods divine power and wisdom; and supposing his general concurrence to the maintenance of the Laws by him establish't in it; the *Phænomena*, he endeavours to explicate, may be solv'd *Mechanically*, that is, by the Mechanical affections of Matter, without introducing any precarious Principles, such as he esteems to be *Nature's Abhorrence of a Vacuum*, *Substantial Forms*, or Dr. Mores *Hylarchical Principle*, i.e. (in plainer terms,) his created *Immaterial Director*. But in this Explication, our Author, to make his Discourse the more Instructive, occasionally adds several Considerations and Experiments, for the clearing up and confirming some *Hydrostatical Truths*, that he fears are but by very few assented to, or perhaps so much as understood. Amongst them, he discusses at large and solves this noble Problem, *Whence it is, that Urinators or Divers are so far from being killed or oppressed by the Weight of the incumbent and ambient water, that they are not so much as hurt by it.* Concerning which he takes notice, that in this Question 'tis taken for granted, that *Divers*, though at never so great a depth, feel no pressure against them by the water; which he saith is an affirmation in point of fact, of whose truth he makes some question, alledging the reason why he doth so.

To this *Hydrostatical Discourse* our Author subjoins a *Letter*, dilucidating an Experiment of his about a way of *Weighing water in water*, upon the occasion of some Exceptions made to it by Mr. *George Sinclair* in his *Hydrostaticks* lately printed at *Edinburg*.

Upon which occasion the Publisher of these Papers finds himself obliged to take notice of a Pamphlet annext at the end of this same Book of Mr. *Sinclair's*, called, *A Vindication of the Preface of the Book intitul'd, Georgii Sinclari, &c. Ars nova & magna Gravitatis & Levitatis, from the challenges and reflexions of the Publisher of the Phil. Transactions, as they are to be found in Numb. 50. Aug. 16, 1669.*

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Not

Not to reflect, as it deserves, upon the subtle leaving this Pamphlet out of the Copy, that was by Mr. *Sinclair* presented to Sir R. *Moray*, a person whom he knows to be very far from allowing his pretences in the *Preface* here question'd ; the said Publisher first of all desires the Reader to observe, how grossly Mr. *Sinclair* prevaricates in his pretended Vindication, when, alledging the Publishers proof, whereby he asserts, that the Manuscript of *Ars nova & magna*, &c. was not committed by the Author to the Judgment of the R. Society, he omits the main part thereof, contained in these words, *Which* (recording) *is yet their constant and careful practice to do in all things of that nature.* For, if this had been taken in by M. *Sinclair*, he must certainly have thought, none but such as are wholly ignorant of the Candor and Justice of that Illustrious Body, and of the care of the sworn Secretaries thereof, would believe him in what he so boldly and immorally asperseth them with, viz. *That it was the interest of them, who had taken out the purposes of his MS, to procure it should not be recorded in the Register ; Unless it should be said (a thing very hard to imagine) that the Registry had been in this only case purposely omitted at the solicitation of the pretended Plagiaries ; which who they be in particular, hath not yet been declar'd by M. Sinclair : Who, in the next place, might do well to consider, not only how much, before his pompous Ars Nova & Magna came abroad, had been printed of the Doctrine of the Air's Pressure, and likewise how well was known the Way of Counterpoising Air with Quicksilver in Glass-tubes ; but also, that in this so generally Inquisitive and Experimental Age it not seldom comes to pass, that Learned and Curious Men, proceeding in their Researches upon Solid Principles, though they reside in places far distant from one another, and without any mutual communication or knowledge of their respective studies, yet happen to light upon and discover the same things and truths ; as may easily be made out by undeniable proofs in the matter of Curve Lines found equal to Straight ones ; in the Doctrine of Motion ; in the Anatomy of Plants, &c. And having said thus much, if M. *Sinclair* do yet persist in the good opinion he hath of himself, we shall leave him still to feed upon it ; though we think,*

it

it may be much sunk by this time from what some of his friends very worthy men and competent Judges of mens habilities, from hence have represented unto him; To return then to our Author, He

In the *fourth* Tract endeavours experimentally to shew, that, though not only the *Peripatetick* Schools, but the generality of Philosophers both antient and modern, do as well as the Vulgar, ascribe the Ascension of Lighter bodies in water to an Internal principle, by them called *Positive Levity*; yet we need not admit any such thing for the true and adequate cause of the emersion of wood and such lighter bodies, let go under water.

In the *fifth*, he adds to the Proofs, already given of the Power of the Spring of the Air, some of the Operations he hath discover'd it to have upon Bodies placed *under water*. In the doing of which he employs two sorts of Tryals, shewing, that a small quantity of inclosed Air may by its pressure have a considerable operation upon bodies cover'd with water, notwithstanding the interposition of the liquor; which Pressure may be manifested, *both* by what it directly and positively operates upon bodies under water; *and* by the things that regularly ensue upon the Removal of the inclosed Air, or the weakning of its Spring.

In the *sixth* and last, the Author considering that it hath prov'd a great Impediment to mens freely acquiescing in the Doctrine founded on the *phenomena* of his Physico-Mechanical Experiments, that if the Atmosphere could really exercise so great a Pressure, as he ascribes to it, it would unavoidably oppress and crush all the bodies expos'd to it; He therefore employs in this Tract divers weighty Considerations and remarkable Experiments to remove the force of that plausible Objection.

II. *Esperienze intorno à diverse cose naturali, & particolarmente à quelle che ci son portate dall' Indie; fatte da Francesco Redi. In Firenze, 1671. in 4°.*

THIS Learned and Observing Author, desirous to examine many Traditions about Natural things, takes occasion from certain *Snake-stones*, described by *Garcias ab Horta* and others,

and by the Portugueses call'd *Cobra de Cabelo*, found in the head of a certain kind of Serpents of *Indostan* and other parts of the East-Indies, and believed to be a sure Antidote against the Biting or Stinging of venomous animals, when applied to the wound, to which 'tis said it will stick very fast, till it have imbibed the poison; which done it will fall off: This being invalidated by the Author upon many Tryals, he affirms to have made with many of such Stones, of divers sorts and sizes, and of such as were esteemed to be most genuin, lent him by those very men that had brought them out of *India* themselves, and were persuaded of the great efficacy of those very individual Stones; he proceeds thence to the examination of divers other received vertues of things, found by him likewise to be fictitious, or at least not answering his expectation in the Experiments, himself made with them.

Next, he takes notice of several things, that produce real effects but not always, by reason of some impediments intervening. E.g. 1. That *Aqua vite* swims upon Oyl-olive, which it doth, not when 'tis undephlegmed, but when highly rectified. 2. That all natural waters of rivers, springs, conduits, &c. have been formerly observed by the *Florentin* Academicians to grow turbid upon the Infusion of water distill'd in a Leaden-bell, except the Conduit water of *Pisa*; yet of late this *Pisa*-water grows turbid also: of which the reason is here inquired into. 3. That waters distilled in Glass, if mingled with waters distilled in Lead, grow not troubled, by the observations of the same *Florentins*: Whereas this Author affirms, that sometimes 'tis otherwise; he having stilled *Parietaria* in a Glass still, and shifted the Receiver 14 times, and mingl'd all these shifted waters with Rose-water distill'd in Lead, and yet found them all become turbid; though he often repeated it in several months. Yet after he distilled in *balneo* the remainder of these 14 shiftings in a Silver-vessel with a Glass-head, changing the Receiver 8 times, he found indeed the water, that was gathered in the eight and last Receiver, untroubled, though he mingled it with several shiftings of water stilled in Lead, but all the other 7 shiftings grew still turbid, when thus mixed. 4. That Cinnamon-water, distill'd in Gold, Silver, Glass, with a Glass-head, and kept in Glass, re-

mains

mains always clear, but in Crystal of *Pisa* grows turbid in a few hours, and then milky, and in few days after, yellow, and at last bitter; whereas in Crystal of *Rome* and *Venice* it grows not troubled but after 2 or 3 days, and never yellow, nor bitter; and in Crystal of *Paris* it will scarce grow turbid but after a very considerable time: Which whether it depend upon the diversity of the materials, or the different way of preparing the Crystal, or both, or upon other causes, is here curiously discussed. 5. That Powder made of Niter, Salt of Tartar & Flower of Sulphur, will sometimes fulminate, sometimes not. 6. That Oyl of Tobacco kills not all animals, nor dispatches those which it kills in the same space of time. Where he speaks of the great difference, he found between the Tobacco of *Brasil* and that of *St. Christophers* as to this effect: *Varino* and *Brasil*-Tobacco producing almost the same effect, whereas that of *St. Christophers*, *Terranova*, *Nieve*, *St. Martyn*, have very different effects. 7. That the fish *Torpedo* causeth stupefaction; but to our Author then only, when he held and squeezed it, not at any the least distance. The Fish he dissected, to see whether he could discover the seat and cause of its stupefactive power; and notes, that all that part of it between the gills and head, and the place where the fins are, as far as to the foremost extremities of the whole body of it, is taken up by a fibrous, soft and very white substance, the fibres being as big as a big swans-quill, and interlaced with nerves and sanguineous vessels; and the ends of these fibres reaching to and touching the skin of the fishes back and breast, so that they all united together form two Muscles of a *falcate* figure, weighing $3\frac{1}{2}$ lb. in a fish of 15 pound weight, as this was. In which two Muscles he suspects that benumbing force to reside more than in any other part; observing, that that virtue was felt more vigorous, when he took the *Torpedo* and squeezed it in his hand; at which it strove to slide away. By the by, he took notice, that the *Iris* of this Fishes Eye is of such a figure, that half of it is concave, the other half convex, and that the convex part entring into the concave, the pupill is closed. Many other things he observed in this Fish, which see in the Book it self. 8. That certain *Water-nuts* or *Efts* in *Brasil*, *Cuba*, *Mexico*, breed a stone in their stomach, which being pulverised are by *Ximenes* himself affirm'd to cure Nephritical pains, and even to break the stone. Which
yet

yet being often tried by the Author, had no effect. No more had Eagle-stones, famous for facilitating the travel of women; nor stones swallow'd by *Caymans*, said by *Monardes* to be very powerful in curing Quartans. 9. That the great digestive power in Fowl being notorious, he made very many Experiments upon Hens, Ducks, Capons, Pigeons, by cramming into them many Crystal-bullets, both hollow and massy ones; in which, upon killing & opening those animals, he found many very remarkable changes; too long to be here recited. We shall only note thence, that by some of his Tryals he saw verified that *Florentin* Experiment, by which Glass-bullets in the stomachs of Hens and Ducks had been found full of a certain white matter like curdled milk; which he thinks comes thither, from being expressed out of those innumerable *papillæ* which are seated in the inner part of the *oesophagus* of all Fowl, that is fastned to the upper orifice of the stomach. Whence he is inclined to believe, that Digestion in the stomach of Birds is not fully made by Grinding alone, but that there is required a *Menstruum* besides, to ferment, dissolve, subtilise, and to convert the meat already ground into Chyle: And he is persuaded, that the gravel and stones, swallow'd by Fowl, and stir'd about by the Muscles, perform the office of Teeth.

To these he adds some Tryals made by himself with the famous *Glass-drops*, which, when *temper'd in water*, and crammed into Ducks and Capons, were after many days found intire in their stomach, though afterwards they flew in pieces, as they are wont to do, the tail of them being broke off. Two also of the same kind being weighed and given to a Capon to swallow, were after 30 days taken out sound, but weighed less between 2 and 3 grains. But having *un-temper'd* (*stemperato*) or taken off the temper with *fire*, of one of these Drops, weighing three penny weight, and crammed it into a Capon, he found it had lost 4 grains in 4 days; and being given to such another Fowl, he found, it had, in 6 days more, lost 9 grains: An Argument, he saith, that those Drops are much harder when temper'd in water, than when un-temper'd with fire.

He likewise tryed small *Diamonds*, *Topazes*, *Leaden-bullets*, *Bohemian Jasper*, *Porphyre*; and found, the first had lost nothing at all of their weight in the stomach of a Duck; the second, almost

nothing; the third, had lost considerably in the stomach of Hens; the fourth and fifth, nothing at all, after many days, in the stomach of Hens, Ducks, Turkey-cocks. Four *Pearls*, which all of them altogether weighed 12 grains, lost 4 grains in the stomach of a pigeon in 29 hours; and 8 other pearls, weighing together 30 grains, lost, in the stomach of another pigeon, 20 gr. in two days.

Having done with this sort of Observations, he goes on to recite more relations about other vertues ascribed to divers other Natural things; As, that the Blood of a *Rhinoceros* doth marvels in curing the Colick, and in stopping the Bloody flux; and the Decoction of the skin of the same is very stomachical; and the Horns of it very Antidotal. All which he found groundless in his frequent Tryals.

Hence he proceeds to discourse of the Horns of Staggs and other Deer, and observes, after others, *that* Staggs put forth their first Horns the second year of their age: *That* they cast them every year a little after the beginning of March; *That* those that are well-fed and lusty, cast them off first, the lean ones stay longer, sometimes till the end of April: *That* these Horns are fastned to the bones of the skull, not to the skin only, as some say: *That* 8 or 10 days after they are cast, new ones bud forth, which are hairy, growing hard in about 3 months, at which time the Stag rubs off the hairy skin: *That* the branches of these Horns are more or less in number according to the Age of the Staggs, and the several Countries wherein they live, the oldest of them in *Tuscany* having but 6 or 7, and very seldom 8 or 9 on one horn, but in *Germany*, and above all in *Saxony*, 14 or 15, and sometimes more: *That* a young horn, yet tender, if cut, especially at the bottom, emits blood in streams & so violently, that the Stag often dyes of it: *That* this blood coagulates like the other blood of the Stag, that comes out of the veins or arteries; though this be denied by *Aristotle* and *Galen*; sanguineous vessels being diffus'd through all the Horns when tender, for the conveyance of sufficient nourishment; though by little and little they are dried up: *That* a Hart being castrated whilst young and before it puts forth his Horns, never gets any; if gueld when horn'd, he never casts them, but keeps those always he had when he was cut.

After.

After this discourse, he examines what is related of a certain Spice, called *Pimienta di Ciapa*, which *Ciapa* is a province of *Guatimala* in New Spain; and esteems that Spice to be the same with what *Hernandez* describes under the name of *Xacoxochitle*, or *Pepe di Tavaasco*: which by his description seems to be the very same with our *Jamaica-pepper*, it having those several tastes of Cloves, Pepper, Cinamon, Ginger. Mean time the virtue, for which it is by writers commended, against the Epilepsy and the *Gutta serena*, he saith he could never find in it, though he acknowledg it to be a good Cephalic, and very Stomachical.

Next, he speaks of the praises given to *China-fennel* against many infirmities, though he found it little better than the European Fennel, Annis, and Cumin. What *Ximenes* relates of the chips of *Sassafras*, that, being kept 7 or 8 days in Sea-water, they make it fresh and potable, he was not so happy to find true, though he kept *Sassafras* thin sliced, in considerable quantity, infused 20 days in a small proportion of Sea-water. What is written of the Root *John Lopez Pineiro*, growing in *Zanguebar* in Africa, and of the Root *Della Manique*, both commended for their virtue of Infallibly curing Tertians and Quartans, and the bitings and stingings of venomous animals, he had neither the good fortune to discover. Further, what is recorded of the shrub of *Cheggio*, a lactescent plant, found in *Cambaja*, that the knobs and beards of it, that look Nord-ward, are only Anti-apoplectical, but those that look South-ward, are so far from being endow'd with that virtue, that they are poisonous and deadly; he could not find to answer his Tryals: Neither could he find any great matter in the celebrated wood of *Calamba*, nor the *Vanillas*, nor the wood of *Lahor* and *Solor*. But he must acknowledge the virtue of the Bark of the *Peruvian Tree* in *Gua-jachil*, known by the name of *China di China*, curing Quartans and all sorts of Tertians. He wisheth, it were as true, what is recorded in the praise of those two Herbs of China, called *Pusu* and *Gudseng*, whereof the former is said to render men Immortal, the other, to preserve them always in good health.

He cannot believe what *Martinus* in his *Atlas* relates of certain Fiery Pits in *China*, able to dress any meat in them, and incapable to consume wood: Nor what is written of the two Rivers, *Chiemo* and *Jo*, in the province of *Xensi*, the waters of which are said to be so pure and light, that the lightest straw sinks in them: Nor that the Leaves of certain Trees are metamorphos'd into Swallows; nor lastly, that in the Seas of *China* there are certain scaly Fishes of a Saffron-colour, which in winter live in the water, but in spring cast their scales, get feathers and wings, and so fly a shore into the woods, and there live all summer and autumn, but then return to their former shape and betake themselves again to the habitation of the Sea.

Errata left un-corrected in N. 90.

In the Dedication p. ult. l. 8. for Rhine r. Rhone. p. 5166. l. 32. r. above it. p. 5167. l. 7. r. what the other. p. 5168. l. 27. r. than is ordinarily accountable for.

Errat. in this Numb. Pag. 5177. l. 9. in the margin r. diminut.

LONDON, Printed for John Martyn, printer to the R. Society, 1673.

PHILOSOPHICAL TRANSACTIONS.

April 21. 1673.

The CONTENTS.

An accurate Description of the Cacao-tree, and the way of its Curing and Husbandry, &c. Directions for Inquiries concerning Stones and other Materials for the use of Building: together with a suggestion for retrieving the Art of hardning and tempering Steel for cutting hard Marbles. An Account of the Advantages of Virginia, for building Ships. A way of making Vines grow to advantage, and for the obtaining riper, and greater plenty of Grapes. An Observation made upon the Motion of the Hearts of two Animals, after their being cut out. An Accompt of two Books. I. Vini Rhenani, imprimis BACCARACENSIS, Anatomia Chymica, a Joh. Dav. Portzio Ph. & M.D. II. De Poematum Cantu, & Viribus Rhythmi.

An accurate Description of the Cacao-tree, and the way of it's Curing and Husbandry, &c; given by an Intelligent person now residing in Jamaica.

— I Send you on this Ship a box, that hath in it a Cacao-tree painted to the life. 'Tis certain, nothing was ever more like; and this Picture contains the whole History of the Cacao. It's of an old Tree; the body of which (as they commonly are,) is about 4 inches in diameter, 5 foot in height, and above 12, from the ground to the top of the Tree.

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These Trees are exceedingly different amongst themselves; for, some shoot up in 2 or 3 bodies; others in one, as this. Their Leaves are many of them dead, and most discolour'd, unless on very young Trees. They are not at all beautiful, nor so agreeable to the Eye, as the Fruit is to the Palate of them that love Choccolato. The number of Codd's the Tree produces, is uncertain: But we reckon, a bearing Tree yields from 2 to 8 pound of nuts a year; and each Codd contains from 20 to 30 nuts.

The Manner of Curing them is; to cut them down when they are ripe, and to lay them to sweat 3 or 4 days in the Codd's; which is done by laying them on heaps. After this they cut the codd's, and take out the nuts, and put them into a trough cover'd with plantan-leaves, where they sweat again about 16 or 20 days. The nuts that are in each codd, are knit together by certain fibres, and have about them a white kind of pulp, that's agreeable to the palate. By the turning and sweating their little strings are broken, and the pulp is imbibed and mingled with the substance of the nut. After this, they are put to dry 3 or 4 weeks in the Sun, and then they become of a reddish dark colour, as you see, and so are cured.

What is remarkable in this Fruit is, that the Codd's grow only out of the Body or great Limbs and boughs; and that at the same time, and in the same place, there are blossoms, young and ripe fruit.

These Trees bear at different times; the greatest crop at most of our Cacao-walks is in *December* and *January*: But at one of Colonel *Modiford's* walks, whence this Tree was taken, they bear most in *May*; yet it's not above 5 miles from those walks, which bear alwaies in *December*: But those that bear then, have some fruit in *May*; as the other have in *December*.

It's planted first in the Nut, alwaies under shade: Some do it under *Cassave*; others, under Plantan-tree, and some in the Woods. The Spaniards used a certain large shady plant, call'd by them *Madre di Cacao*: We only th'others; and seldom transplant, only where it fails, as it doth many times in open, poor and dry lands: for, this Tree requires to be shelter'd

ter'd from the Sun while 'tis young, and alwaies from the Nord-East winds; and to have a fat moist low soyl, which makes them to be planted commonly by Rivers and between Mountains: So that 'tis ill living where there are good Cacao-walks. In a year's time the Plant comes to be 4 foot high, and hath a leaf six times as big as an old Tree, which, as the Plant grows bigger, falls off, and lesser come in their place, which is another extraordinary quality of this Tree.

The Trees are commonly planted at 12 foot distance; and at 3 years old, where the ground is good, and the Plant prosperous, it begins to bear a little, and then they cut down all or some of the shade, and so the fruit increases till the 10th or 12th year; then the Tree is supposed to be in its prime. How long it may continue so, none with us can guess; but it's certain, the root generally shoots out suckers, that supply the place of the old stock when dead or cut down, unless when any ill quality of the ground or air kill both.

Neither we, nor our neighbours of *Hispaniola* or *Cuba* know, what to attribute this late blast of the Cacao to. Some fancy, 'tis age; others think, 'tis worms; some believe it to be want of shade, or an ill quality of the winds; but most judge it's some Constellation or ill Disposition of the Climate. We formerly might have made here 2 or 300000 pound *per annum*; but these two last years hardly 5000. Yet are not people at all discourag'd, but plant it faster than ever, especially to the Eastward, where are divers young walks, that have not one dead or blasted tree.

Cacao was originally of these Indies and wild. Towards *Maracajo* are divers Spots of it in the mountains; and I am informed, the Portugueses have lately discover'd whole Woods of it up the River of *Maranon*.

This is the History of the Cacao and its Husbandry. You cannot be ignorant of its use and virtue; but nothing, me thinks, commends it so much, as that it should pass by detail for Money in *New Spain* and the Silver-Countries.

Directions for Inquiries concerning Stones and other Materials for the Use of Building; together with a suggestion for retrieving the Art of hardning and tempering Steel for cutting Porphyre and other hard Marbles.

1. **T**O observe the great difference in the degrees of hardness in Free-stones, together with the other qualities to be found in them, and to inquire into their Causes: There being (e.g.) a sort of gray Free-stone at *Paris* every where on the South-side of the River *Sene*, which is of a reasonable course greet, and so soft when first taken out of the Quarry, that 'tis drest and hewn with broad sharp Axes almost as easily as dried Clay; but grows harder and harder in the Air very durable and exceeding fit for building. The Port-land-stone of a fine chalky greet, fit for all curious hewn and carved work, though not so fit for Water or Fire. *Quere*, the Cause of this unsuitness. On the contrary, the Free stone in *Kent*, of a whitish gray colour, lasts well in Air and Water; the greet thereof less fine and chalky, than that of *Portland*. The *Derbyshire* Freestone, though it endure the fiercest fire, yet brittle, and so unfit for fine and curious Workmanship.

2. Concerning *Marbles*; whether *Salisbury* Marble be a true, though coarse, Natural Marble? Whether *blew* Marbles, coming much from *Genoa* and *Legorne* for ballast, be harder then *white* Marble, but take not so good a polish? Whence comes the best *black* Marble? Whether *Porphyre* differ in nothing from Marbles, but in hardness?

3. To inquire after the wayes of making *Artificial* Marble; and whether that, with which the Elector of *Bavaria* hath adorned his whole Palace at *Muncken*, so as to one that suspects not the artifice, it looks as rich and beautiful as any Palace in *Italy*, is made (as some affirm) of such *Gypsum*, as makes the Plaster of *Paris*, which being put over the Fire and let boyl till it cease of it self, after being cooled is kept dry for use; mixing Painters colours with it for tinging or colouring it according to pleasure, and using it as the burnt *Gypsum* is at *Paris*?

4. To

4. To advance the Art of tinging white Marbles, so as to make the tincture penetrate and colour them at a considerable depth; and to endeavour to bring this way of colouring to as great perfection, as Enamelling is, by Painting faces and Stories, and all kind of Landskips and Perspectives upon white Marble with colours not delible by any thing, that does not destroy the Marble.

5. To take notice, whether *Flint-stones*, to be met with in great abundance in *England*, are constantly found in the Chalky rocks, that abound here in many places of the Kingdom; they being oft encompassed with crusts of Chalk? And whether Chalk turns into Flints?

6. Whether *Brick-walls* do not make a room much wholesomer, then Freestone or Marble; Bricks imbibing the moist vapors of a room so that they never sweat, as Marbles and some Freestone are found to do, by coagulating the vapors into drops by the coldness of their surface?

7. To try the truth of *Vitruvius* his Note, importing, that the Romans anciently let their Bricks stand to dry a whole year, sometimes longer, before they were burnt: It being observable, that those stupendious remains of that ancient Amphitheater of Roman Work being all Bricks, near *Bordeaux*, are still as firm as a Rock, excepting such places, as the rains and storms have spoiled by getting in at top: Which may also be seen in divers other old structures in *Italy*, *France*, and elsewhere.

8. To inquire after the antient way of Plaistering, used by the Romans, which to this day, where it hath not met with violent knocking or breaking, is to be seen as free from cracks or crevices, and as smooth and polisht, as if it were Marble: Witness their Aqueducts, whose bottoms and sides were thus plaistered, and particularly that, whereof some yards are still to be found on the top of *Pont de Gare* near *Nismes*, for the support of which that famous Bridge was built to carry water to the said Town.

9. To take notice of the roofs of Houses and the floors of Rooms at *Venice*, covered with a kind of Plaister, that is
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said to endure the Sun and weather for whole ages without cracking or spoiling, and without much wearing in a very long time.

10. To try, whether such a kind of Plaister may not be made by taking powder of *Gypsum* so prepar'd, as is the artificial Marble abovementioned, and mixing with it a certain proportion of Rosin, Colophon or Pitch, as also Brimstone and crude Shells, all beaten to dust; adding thereto some water, and heating all upon the fire, and then using it hot; it being pethaps not amiss also, to add some wax and oyl of Terebinthin, as being very binding, and ingredients in some Cements.

11. Whether Mortar or Limestone will become much harder and more tenacious by using strong *Wort* in stead of Water? And what proportion of Malt will serve to what quantity of Lime?

12. As for Quarries, 1. Whether a Bed of any kind of Stone be usually upon the matter equally thick all over, and the superficies above and below do lye always in parallel and straight lines, or not considerably nor frequently varying? 2. Whether these Plains are seldom or never, nor frequently, parallel to the Horizon, but for the most part alwaies reclining; so as to make an angle with the perpendicular? 3. Whether sometimes, when such Beds of Stone or other things do lye in Hills or high grounds near the superfice, they terminate and are cut off every where at the grasse (as they call it) or the day, or some place above the valley about it; and yet, after such interruption, or being intersected by rivers or brooks, and even arms of the Sea of considerable breadth, a Bed of the same kind of Stone or Mineral will be found lying in the same plain with that so interrupted or cut off in the adjacent plain, or opposite high ground, or on the other side of such river or arm of the Sea? And whether instances of this are seen in the Cliffs in Kent, and Picardy; and in Fife and Lothian, &c? And whether in the last of them the Beds of Coal and other Minerals be cut off so deep and wide, as to make way for the passing of the *Firth* there between them; yet the same Bedds run cross it under ground un-interrupted, having the very same kinds of Coals, with the same thickness and position; being at *Cochenny* about

about *Dyfort*, from which it lyes about South-west, the Sea being there some ten miles broad: And the like at *Cubross* and *Burrow Stomness*; distant some four miles. In Testimony whereof this last hath been (by very credible relations) wrought under the Sea, almost half way over, there being a *Mote* half a mile from the Shoar, where there was an entry that went down into the Coal-pit under the Sea, made in a kind of round key, or Mote, as they call'd it, built so as that it kept out the Sea, which flow'd there 12 feet; on which the Coals were laid, and where a Ship of that draught of water could lay her side to the Mote, and take in her coal. Which colliery is said to have belonged to the Earl of *Kinkardin's* Fore-fathers; in which this is also said to have been remarkable, that the fresh water, which sprang from the bottom and sides of the Coal-bed, was drawn out upon the shoar by an Engin, moved by water, that drew it 40 fathom; though at last a high Tide drown'd all.

13. Whether, as most Trees have the long way such a texture and cohesion of parts, as render them apt to split end-ways, and to break short of the cross-way; so most Stone (Marbles as well as others) have somewhat analogous to Wood in this, that they are much more apt to split or cleave one way than another? And if there be any streaky variegation in the Stone, it runs that way most usually, as also frets and crevices; in so much that in some places, where there scarce appears any crevice or future, being struck on that line where the fissure is, the Stone will cleave or part asunder in the same manner (so to speak) as the halves of a Bean or a Nut-kernel use to do? Lapidaries have attained the skill to discern those fissures even in Diamonds of which they often make good advantage, by splitting them with a small knock of a hammer and chisel, when their shape requires it, or will afford it; for so the principal part is rendred more beautiful, and the piece broken off preserv'd to be reduced to a convenient figure by the mill, by which it must otherwise have been ground to dust.

14. To take particular notice, that in the heart or body of a Stone are frequently found entire distinct Stones, of a quite different kind from the Stone, in whose bowels they seem to be contain'd, as *Flints*, *Pebbles*, *Agats*, &c. especially in *Free-*

Freestone, the best of them being said to be obnoxious to these inmates, which when they chance to ly, where the intended surface of the Stone, when hewn, is to cut the body of them, they being knockt out, the Stone will need to be patch't, or, if that be not faisible, the Stone will not serve for the purpose intended.

15. To inquire how Stones grow, whether by a kind of Vegetation? It being affirm'd by some, that a Peble being put in a vial with water, so as the stone can easily enter into it, though almost touching the neck every where as it enters, it will, within 12 Months or so, increase in bulk so much that it cannot come out where it went in : As also, that Pebles and Flints have been observed to grow so fast in some grounds, that all being taken away that can be seen now, within a year or two there will be new ones found there, like the former.

16. Whether Beds of Sandy and Loamy matter, and the like, do not in time harden into Stones ? The Quarries about *Paris* seem to favour the affirmative : And near *Mansfield* in *Sherwood-forest*, where some high wayes through sandy grounds are worn some 8 or 10 foot deep, the faces on the backs on either side are said to be hardned into a strong crust, which being broken off to the thickness of perhaps 8 or 10 inches, all within is still sand. Now it being exposed to the Sun, Wind and Rain, it seems not irrational to presume, the Surface thereof may be easily hardned into Stone. Nay 'tis notorious, that in divers places in England, Scotland, France, &c. water dropping through the Crannies of the Roofs of Caves in rocks, does in a short space of time produce heaps of Stone, where it falls; the particles of sandy and loamy Stuff, that are conveyed along in the body of the dropping water, being left to cling together, when the water is drained away from them. Such was there found in great store in a Cave near *Enston* in *Oxfordshire*, where was built a famous *Grotta*.

To endeavour to retrieve the Art of hardning and tempering Steel for cutting of Porphyre, &c; which the Egyptians were masters of, of old, and after them the Greeks and Romans : Insomuch that the neat and curious hewing and carving of Obelisks, Colosses, Statues, Pots, Urns, as also Porphyre and other hard Marbles, is now the Object of admiration to the most

most skilful workmen, who know not which way to rough-hew Stones of that untractable hardness. The retrieving of which skill would be of good use, now that Curiosities of workmanship begin to recover, and many eminent persons do countenance and encourage the endeavors of such, as apply themselves to the retrieving of such commendable practises, as were familiar to the Antients, and improve what they know of them and of others with new additions and inventions, which in this knowing and inquisitive age is like to be driven on as far as humane industry can go. Some curious and intelligent persons have of late already taken laudable pains in this very Art. And some Masters in Italy pretend even to have hit upon the old Art, or inventions as good; but they, it seems, envy the world the knowledg of it.

An Account of the Advantage of Virginia for building Ships; communicated by an Observing Gentleman.

1. **T**HE Country of Virginia all over abounds with large and tall *Oakes* of at least 50 or 60 feet in height of clear timber, without boughs or branchings, being very fit to make plank of any seize, very tough, and excellently well enduring the water; as we know by good experience.

2. With abundance of *Pines* for Masts, no country, that we know, in the world is better stored than *Virginia*. Besides there is another sort of wood, called *Cypress*, which is far better than any *Pine* for Masts, it being of as tough and springy a nature as *Yew-tree*; bending beyond credit; when dry, much lighter than *Fire*, and so well lasting in wet and dry, that it seems rather to polish than perish in the weather: And this is known by much use, and several Experiments.

3. The same Country affords great abundance of *Old Pine* for the making of *Rosin*, *Pitch* and *Tar*; of which they have there made several quantities for their own use, and if occasion were, could fully supply the Kingdom of England

4. The conveniency of planting *Hemp* for Cardage and *Sail-cloths* in that Country is so great, that England might in
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a short time be supplied therewith, without being beholding to other nations for it.

5. To these particulars add the great abundance of *Iron-stone* in Virginia, which hath already been tryed and found very good. the conveniency of Wood and Lime-stone being a good inducement to the making of Iron, which might be done at a much less rate there than here. Of which there hath been a calculation formerly made, considering every mans labour, and what is necessary to be disbursed for every Artist and Labourer, as to their transportation, diet, and all other materials for the work of Iron. All which is referred to the consideration of those, who are concerned in a Matter of this importance.

A Way of making Vines grow to advantage, all over the roof of a house; communicated by Mr. John Templer.

I Have lately seen a pretty and pleasant culture of Vines at the house of a Gentleman, who makes very good White-wine of his own Grapes. He lets Vines ascend by one single stem to the Eaves of his house (cutting off all the luxuriant branches by the way,) then gives them liberty to spread upon the tiles, all over one side the roof of his house. Thus he furnishes his dwelling house, and many out-houses; by which means the vines are no hindrance to his other Wall-fruit, and the rays of the Sun being almost direct upon the Vines, he hath riper, sweeter and greater plenty of grapes, than when their vines are placed as Wall-fruit.

An Observation, made by the same Mr. Templer upon the Motion of the Hearts of two Urchins, after their being cut out.

— **W**Hen I had written thus far, I was diverted by a couple of living *Urchins*, which were presented me by a Shepherd. I shall now mention no more than my cutting out their Hearts; whereupon I found the *Systole* and *Diastole* to continue full two hours, while the hearts lay upon a glazed earthen white plate in a cold window. The distance
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of their *Diastoles* was unequal in time, but very large for half an hour, and then sensibly diminishing until they ceased at the two hours distance; and would not then be re-inforced by a needles point, which for the half hour preceeding they would answer at any time. But here I must ask, shall we call these Hearts dead after the first hour? If so, than that Paralytical arm is much more dead, which is deprived of Sense but not of Motion; a famous instance whereof the Immortal *Harvey* gives us somewhere, (I cannot quote the place, not having seen the book since the flames consum'd my Library,) in his *Exercitat. de Gener. Animalium*; since this Heart had not only Motion, but Sense too, upon the pricking with the point of a needle.

If you object, That the pricking of a needle made a compression of the fibres, and, by consequence, of the included Spirits, and they by vertue of their own Spring rebounding imitated a *Diastole* of the heart: I answer, that after the Hearts had ceased above $\frac{1}{4}$ of an hour, so as a needle pricking them caused no Motion; yet upon setting the plate upon the hearth in the Chimney, in about two minutes of time they began to beat, though but weakly; and upon eight minutes continuance they beat freely; and when removed into the window again, continued their pulsation, without pricking, above an hour, and might have done longer, could I have spared my servant to attend them longer. Peradventure we may hence conjecture at the cause of Life and Death. And when shall we say then, any Animal or Insect is dead, if it hath Motion?

Some Communications out of Turkey, by persons residing there.

THere is a Disease, which reigns in the Country about *Aleppo*, and as far as *Bagdat*, invading both sexes, all sorts of ages, and strangers as well as natives. 'Tis commonly call'd *Il mal d' Aleppo*, and appears to be in the skin a small *pustula* or wheal, hard and red, the head whereof is scarce bigger at the beginning than the point of a pin; afterwards growing bigger, and being nourish't by five or six little roots or fibres, it goes on to its height for the space of about 6 months; and in as many more comes to its declination: So that the whole pe-

riod of this disease is generally comprised within the space of one year. But this *Pustula* hath hitherto yielded to no remedies, neither in the beginning, middle, or declination, but hath rather been exasperated by them, though they were *anodyna*. It is wholly to be left to Nature, and, if you do so, there is no pain or trouble in it. It takes people not once, but often, and it seizeth on several parts of the body; and if it do so on the face (as often it doth) it causes a remarkable scar, which yet by little and little vanisheth.

As to *Feavers* at and about *Aleppo*, though they have the same *Type* there as in *England*; yet there are two things peculiar in them. One is, that in Acute feavers, Cold sweat commonly signifies recovery, but Hot sweat portends death. The other is, that in such acute feavers even an intermitting pulse denounces no danger.

Touching the *Leprosy*, which anciently was so frequent a malady in these Countreys, 'tis now scarce to be found there, though at *Damascus* there is still an Hospital standing, formerly built for the relief of persons thus diseased.

As for the reason, why the City of *Constantinople* is so much subject to the *Plague*; some are of opinion, that the multitude of Slaves, yearly brought by the *Black-Sea*, and their hard diet and usage, begets this corruption: Others judg, that the commonalty there, feeding for the greatest part of Summer on Cucumbers and Melons, and drinking water upon them, without the Use of helps to correct the crudities, fall into malignant and pestilential feavers. But the Physicians generally conclude, That the Air of *Constantinople* is infected by the North-East-winds, which blow commonly for 3 months, beginning about the Summer-solstice arising from unwholesome Marshes in *Tartary* and *Muscovy*, and passing over the *Black-Sea*, (a place known to abound with Fogs,) bring with them certain dispositions tending to corruption; which working upon bodies already prepared by bad diet, may well be iudged, they say, to be the cause of this distemper.

Besides the other uses of *Opium* in Turkey, 'tis common in *Arabia*, to cure Horses with it of the Gripping of the Guts.

As to the *Turky* way of dressing *Leather*, it is to be observ'd, that their *Leather* is nothing so strong and serviceable as that in *England*; an assured proof whereof is the Wearing. And though it be commonly reported, that the *Leather* in these parts, though thin and supple, will hold out water; yet this is to be understood, that the *Turks* in their winter-boots, between the lining and the leather, put a Sear-cloth, which being curiously sow'd in the seams, will keep out water, though you put them in it for divers hours together. In cleaning of their leather, they use *Lime* and *Album Græcum*; and instead of Barks of trees, they employ *Valonia*, a sort of acorn growing on the *Oakes*. I am persuaded, that our *Acorns* in *England*, if they could be spar'd for it, would perform the like effect, and perhaps better; seeing that many times the *Valonia* burns the *Leather* so much as to make it little serviceable; whereas our acorns are probably more temperate, and so might better serve the turn.

An Accompt of two Books.

1. *Vini Rhenani, imprimis BACCARACENSIS, Anatomia Chymica*, à Joh. Davide Portzio Phil. et Med. D. Heidelbergæ, 1672. in 12°.

THis Author treateth in this Book of the Soile proper for *Rhinish Wine*; of the kinds of that *Vine* and *Grape*; and of the *Must*, *Wine*, *Spirit*, *Tartar*, *Vinegar*, and particularly of the two *Salts*, the *Acid* and *Alkali*, as the chief *Ingredients* of *Wine*, and according to *Taschenius*, of all natural things.

Speaking of the fertility of the *Soil* proper for *Vines*, and discoursing of the *Nitrous Salt* coming down in rain and snow, he delivers a way of collecting that *Salt*; of which we leave the skilful to judge upon the reading of the Book.

The *Grape* he affirms to be compounded of an *Acid* and a prevalent *Alkali*; observing, that grapes that are thin-skin'd grow sooner ripe, and thrive even in a temperat climat; and taking also notice, that struck with hail when they are big and begin to ripen, they harden and never grow full ripe.

Having

Having discoursed of the way of preparing Vessels for tuning up of wine; he is very particular in the matter of the Working of wine: Where he distinguisheth between *Effervescence* (which alone he allows to be in Wine) and *Fermentation*; the latter being to him nothing else, than an Action and Reaction of the internal parts of the Acid and Alkali, by which the Spirits are separated *without* Precipitation; whereas by Effervescence he saith there are no Spirits separated, and though therein be also an action and reaction, yet, in his opinion, 'tis done *with* a Precipitation: so that, according to him, all Fermentation is made with an Effervescence, but not *vice versa*; he also affirming, that there may be an Effervescence between two Acids, when their particles are very active and very sharp or when a stronger is poured on a weaker. Where he adds the manner, how the Must doth *effervesce*; viz. by the action of the Alcalifate parts upon the Acid ones, which they subdue; whereupon the Effervescence ceaseth, viz. when that Alkali is altogether satiated by the Acid.

Here he takes notice of that Effervescence observ'd in Wine at the time of the blossoming of Vines; and is of opinion, that it is caused by the Heat, which being at that time more intense worketh upon the said two Salts, and opens them, and so induceth a new Effervescence.

After this he teaches the way of making *Must*, before the Wine works, either by it self, or by boyling it up. *By it self*, when 'tis so close vessel'd up, that it cannot work; which is call'd *Stum-wine*, a liquor that extreamly affects and rends the brain, by reason that the Salts, that were not before set at liberty to work, being now open'd in the Stomack, do send up abundance of those pungent steams, so grievously afflicting the brain. *By Boyling*, when they take strong Vessels not quite fill'd, putting them into a cellar, wherein they make first a mild fire, and then increase it, and after a while lessen it, that so the boyling may cease by little and little of it self; which is perform'd in 36 or 40 hours, according to the bigness of the vessel. Here the Wine-boylers, instead of common candles, (which would melt by the heat) do slit Beech-wood dried and lighted; by which they also find, when the Must is boyled enough

nough, those lights burning very dim as long as 'tis not enough; by reason of the abundance of steams choaking the light; but burning clear, when it hath boiled enough. About 7 or 8 dayes after the Must hath been thus boyled, it begins to work; after which working 'tis call'd Wine.

They prepare another kind of boyled Wine, by boyling the Must to half, and then they leave it so, or put into it, whilst boyling, roots and herbs, according to the several uses they design it for; as *Elechampane*, *Worm-wood*, *Cardus benedictus*, *Centory*, *Rosemary*, *Sage*, *Baum*, *Orang pills*, but especially *Juniper-berries*. Being thus prepar'd, it works afterwards more slowly.

If the boyled Must by two violent an Effervescence cast out the Lee (by which it grows vappous or dead,) they stop it by some fatty substance, as with fresh un-salted butter put upon a vine-leaf, or by fresh lard applied to the mouth of the vessel, whereby the furious acid parts meeting with an alcali, and being saturated thereby,, retire and descend again.

There being two sorts of this wine, Reddish and White, he notes, that the Tincture of the Red is taken away by Sulphur kindled; the Alcalizat colour, got out of the mark or husks, being precipitated by the Acid Sulphur. Sulphur they make also use of to keep their wines, as they also do of Nutmegs, instead of Sulphur.

Discoursing of the *Baccharach*-wine in particular, he notes, that it differs from other Rhenish wines in colour, odor, taste and virtue. After its working it hath first a luteous colour, which they render limpid by *ichthyocolla* (being very Alcalical) cut, and kept infused in rain-water for 10 or 12 hours; and then torn into small pieces, and so put into some Wine, and therewith shaken twice every day, till it be quite dissolved; which is done in 6 or 7 dayes. When dissolv'd, they percolate it through a sieve by powring a little wine upon it, and thus percolated they pour it out of one vessel into another until it foam, and then they pour it into the wine to clarify it; some adding sand or powder'd Venice-glass (meer Alcalies,) whereby, as heavy bodies, the tartareous feces go to the bottom. When they pour this solution into the Vessel, they use a stick, with a little

little board perforated at the end of it, whereby they agitate and beat the Wine in the Vessel, and so render it clear, which it will be after 4 or 5 dayes; and then they vessel it out into other vessels.

As for the *Smel*, that wine is very fragrant, muscatellin and aromatic. Though there be one sort, that is ranck (*hircum olens*, Germanicè *Bruntzer*,) which he saith cannot be imputed to the Vessel, nor the kind of Vine alone, nor to the Earth alone, there being gather'd, in all vintages, out of the same Vine-yard and from the same kind of Vine-stock, a grape which hath none of that smell: But this smell not being perceived before the Working, he takes the cause of it from that Effervescence, whereby the Alkali hath a dominion over the Acid; this urinous smell being to the Author nothing but a meer Volatil Alkali, and the Effervescence, by reason of the copiousness of that Alkali in this kind of wine, during the longer. But that this smell is sometimes so rank in one and the same Vine-yard, sometimes not, he imputes to this, that in some years and soils, the soyl is more impregnated with an Alcalifat salt, which the Air abounds with at one time more than an other. This Alcalifat odor is lost by transvalation, that salt being thereby steam'd away.

The *Taste* of Baccharach-wine is generally very grateful; and for its Virtue, it is more incisive and diuretick, more stomachical and cardiaca, quickning the motion of the Spirits and exhilarating above the rest. Where he takes occasion to give an account of *Drunkennes*, which, in his opinion, is thus caused; viz. That the Bloud is circulated in the arteries more swiftly than it can be received into the Veins; whence comes a Giddiness and Stupefaction, which is frequently attended by a head-ach, from a forcible distension of the vessels.

Proceeding to the *Spirit of Wine*, he declares, that Spirits are nothing else but the fluors of Salts, or Salts resolv'd in their phlegme; Salts being nothing but Spirits concentrated. Where he observes, that from sweet wines, as the Greek, Muscadin, &c. a less quantity of Spirits is obtained by distillation, than from Rhenish, quantity for quantity. He also taketh notice, among

mong the divers wayes of rectifying Spirit of wine, of that of doing it *without fire*, viz. by an intense Cold, congealing the phlegm, and forcing the Spirit into the midst; as also of that of adding a fix't Alkali to the Spirit of wine, whereupon the Alkali, which is empty, will imbibe the phlegm, and so sink withal; whereupon the Spirit may be decanted, leaving the phlegm at the bottom.

Further, he observes, that Spirit of wine is, as 'twere, the Oyl dissolved in its essential phlegm, which solution is made in the working; every fermented Spirit being, to him, a dissolved Oyl; seeing that upon waters being powred on rectified Spirit of wine, it suddenly grows lacteous, just as a Rosin dissolved. It hath a power of dissolving all Sulphurs, whether fixt or volatil; and highly rectified Spirit imbibes Oyl.

He adds, that out of Spanish and other sweet wines less Oyl is drawn, than from Rhenish, and he refers Oyls to acids, because they are corrosif. He saith also that a purer and finer Oyl is distilled out of Rhenish wine, than out of other wines; which he affirms to be of excellent virtue, a great cordial, and to be preferr'd to the famous tincture of Pearl and Coral.

Hence he goes on to the *Tartar*, which he saith is precipitated by the Effervescence or conflict of the Acid and Alkali, and is condensed into a crystallin and stony matter, consisting of an inflammable Sulphur (which is an acid) and a fixt Salt. Here he takes notice, *that* the Tartar of Rhenish Wine and of that of *Montpelier* is preferable to all others; *that* Tartar of white-wine is better than that of red; and *that* sweet wines yield but very little Tartar, since 'tis the plenty of acid parts that afford the biggest and finest tartareous crystals. Yet *Acetum* has no Tartar though it contain a copious *acid* Salt; of which he renders this reason, that the Wine whence the *acetum* is made, had already deposed its tartar; besides that the alcalisate parts are wanting, which must needs concur to the concretion of Tartar.

He subjoyns the various *Uses* of Tartar; To *Gold-smiths*, for purifying and whitening of Silver, by boyling it in water and
 E c c e e c adding

adding a little Allom to it : To *Chymists* and *Physicians* for making their *Regulus's*; for the deflagration and separation of Sulphurs ; for preparing with the Creme of Tartar their *Tartarum Chalybeatum*, *Antimoniale*, *Emeticum*, *Diureticum* ; for making a *Tartarum Vitriolatum*, with Salt of Tartar dissolv'd in Air, and mixt with Spirit of Vitriol by a high Effervescence ; for making the *Spiritus vini tartarizatus* by a tincture drawn out of the Alcalizate salt of Tartar by Spirit of wine, &c.

He concludes this head with directing, how to reduce Salts into Elementary water, viz. by distilling in an Alembic, Salt of Tartar dissolved in the Air *per deliquium*, whence comes a phlegm ; and by distilling again the remainder dissolved as before ; and by going on so, till all be distill'd into a phlegm, and there remain at last nothing but an useless Earth.

After this he treats of *Acetum*, and esteems the best way of making it to be, by exposing it to the Sun-beams, thereby to separate the Spirits, and to open the acid and alcalisate parts, and to consume the phlegm by the heat, and thereby more and more to concenter the acid parts : Yet must not all the spirits avolate ; for then from the phlegm which remains after the distillation of the Spirit of Wine, *Acetum* would be made ; whereas the contrary comes to pass ; and the most generous wines (not the sweet ones, as Italic, Spanish, wherein the Alkali exceeds the Acid) afford the best Vinegar. The heat that is required to dissolve the Salts is a gentle and slow one, lest the remaining volatile parts be driven away, and there remain nothing but phlegm.

He ends all by teaching the way of making *Ceruse* and *Verdigrease* of plates of Lead and Brass ; and by enumerating the many other *Uses* of Vinegar, in fixing the Narcotique power of Opium, in inciding, attenuating, raising the ferment of the Stomack, repelling inflammations, resisting putrefaction, &c.

H. De Poematum Cantu & Viribus Rythmi. Oxon. è Theatro Sheldoniano, 1673. in 8°.

THE Author of this Treatise (which is the famous *Isaacs Koffers*, though not named in the Title) endeavors to make

make it out, that the Musick of the Antients is far to be preferred to that of our Age, forasmuch as Speech, how powerful soever at this day, yet, when put into a Song or rendred Musical, is not of that efficacy in moving our senses, as it was in times of old. For finding out the Cause of which, he observes chiefly three things in Singing; the Harmony, the Words, and the Rhythm ~~and Measure~~; the Harmony respecting the sound, the Words requiring a distinct enunciation for their clear Understanding; and the Rhythm consisting in a due and well-measured motion of the Song. As for the *Harmony*, he acknowledges, that the Moderns have largely handled it, yet without exhausting the argument. But for the two other parts, he affirms, that they have either totally neglected them, or discoursed of them besides the purpose. Which he endeavors to prove from hence, that since all songs and all harmony, how curious so ever, must prove but an empty sound, if the words sung are not understood, nor the motions significant; as they are not in the modern Musick, contrary to what was most carefully observed in that of the Antients. Where he appeals to Experience, by which he saith it will be found, that scarce the tenth part of what is sung by the Musicians of this age can be understood, and that they by making, contrary to nature, those Syllables long that are short, and those short that are long, and often repeating the same words ten times, do so disorder and mangle the genuine manner of pronunciation, that they quite destroy the true nature of the song. Besides this, he observes, that we labour under another very great defect, which is, that we are altogether destitute of the Rhythm, the Soul of Songs. And this is it, *he saith*, which hath induced him, to make out in this Exercitation both the nature of the Rhythm, and its wonderful power in moving and raising the Affections: which with what success he hath perform'd, we leave to the judicious to determine.

Mean time, we shall here take notice of divers particulars, which our Author lays weight upon; such as are:

I. The Invention, Nature, Necessity, Efficacy and Number of *Poetical Feet*, which import different times and measures, and by the means of which not only the visible motions of the Bo-

dy, but also the latent senses and any motions of the Mind may be so lively represented, that there shall be almost nothing in things, that may not be exhibited by well composed Songs and Numbers.

2. The Nature of the *Rythm*, which he defines to be a System or Aggregate of Feet, the Times of which have a certain proportion to one another; which proportion when 'tis apt, the Verses or Songs are said to be *ᾠσυστοιχία*, if not, *ἄρρυθμοι*. Wherefore for the concinnity of the *Rythm*, care must be had above all things, not to couple together such feet as differ in their times.

3. The aptness of the variety of the *Rythm* for expressing either Majesty, or Effeminacy, or Vehemency of Passions, as Anger, Grief, Love, &c.

4. The cause of the joint Loss of *Musick* and *Poetry* in *Greece*, where they had their Birth together, which he esteems to have been the Change of that Tongue and the Prosody thereof; which is the tenor of the voice according to which the Verse or Song is framed. The same Cause he assigns for the Loss of the *Latin* Poesy, and that chiefly upon the invasion of the Roman Empire by the barbarous Nations.

5. The Present Constitution of Poetry, which he saith is so ordered that the sole Endings, together with a certain and determinate number of Syllables, doe in a manner all that is done; without any care, of what nature and quantity those Syllables be, and consequently without *Rythm*, or observation of Metrical feet.

6. The Excellency of the true *Greek* tongue above all those, of which there remains any knowledg amongst us, and the culture of that tongue, rendring it most apt not only for expressing things, but also for framing Songs and Verses. Where the Author takes occasion of discoursing of divers Tongues, and their Peculiarities, after he had first treated of the two things that are to be consider'd in all tongues, the *Sound* and *Accent*, and enlarged upon the power and efficacy of the Letters both Vowels and Consonants, that form the Sound. Here he examines especially the *Genius* of several *Dialects* of the *Greek* tongue

tongue, and observs the Fast and Gravity of the *Spanish* language, the Harshness of the *German*, the Softness of the *English*, the Volubility of the *French*; the Elegancy and Neatness of the *Italian*, the Hardness of the *Polonian*.

7. The Cessation, amongst Musicians, of that great power of moving the Affections, which he saith hath been above a thousand years agoe, and ever since that the use and knowledge of the *Rythm* hath ceased, which alone, in the Authors opinion, could perform what no Musitian this day is able to do; whose Nature therefore and force he explains at large; subjoyning thereto his considerations of the Nature and Power of *Sound*, as farr as it concerns this argument, and inferring from thence the far greater force of those *Rythmical* Motions that are conjoynd with Sound, for the raising of affections: Observing further, that those Motions have so great a power, that even without any voice and sound they can raise affections more strongly, than any voice or oration. For the proof of which he alledges the ancient *Pantomimi*, whose Feet and Hands he makes no less eloquent than the Tongues of Orators; witness *Cicero*, who used to contend with *Roscio*, the Stage-player, which of the two should most vary the same sentence most manner of ways, the one by words, the other by gestures; which maketh our Author proceed so farr, as to affirm, that if we employed as much labour and time in learning the *Pantomimical* Art, as we do in learning a Language, we might possibly come to express our mind and thoughts as clearly by that way, as now we do by the aid of a Language: Nor does he think, that Mankind would suffer any thing by it, if the pest and confusion (*these are his own words*) of so many tongues were banish't, and, in lieu of them, this sole Art of the *Pantomimes* were known by all mankind, and men explain'd every thing by signs, nods, and gestures; in regard of which he thinks the condition of Brutes to be much better than that of men, seeing they signify without an interpreter their sense and thoughts more readily, and perhaps better, than any Men can do.

8. The skill of exploring the Internal affections of the Body by *Touch* alone, as we do perceive the External motions by the *Eye*. Where our Author exceedingly commends the skill of the *Chinese*.

Chinese Physicians (which he asserts to be undoubtedly true) in finding out not only that the Body is diseased, (which he saith is all that our Practitioners know by it,) but also, from what Cause or from what Part the Sickness proceeds. Whereupon he adviseth, that, as we collect the manners and affections of men from their *Outward* motions perceived by the Eye, so we should also, for attaining the Knowledge of their *Inward* and more latent affections, enlarge our Senses and exercise that of *Touch*, till we be enabled to distinguish, and to reduce to certain *classes*, the forms and shapes of every Pulse; whereby we would also be led to understand the power and signification of every such motion. And for the reducing of the several sorts of Pulses, he prefers to the method of *Galen*, (who, he thinks, hath rather provoked then satisfied our curiosity in his 15 Books of the Nature and Differences of Pulses) that of *Herophilus*, of whom he affirms that he hath tied the several manners of the Pulse to Numbers or Metrical feet; the names and powers of which if they were as well known to Physicians, as they are to Musicians and Poets, it would, in his judgement, be exceedingly beneficial for the Life and Health of man. For the encouragement whereof he represents, that, whereas there is not any Kind of motion, which is not to be found in the Musical feet, it would cost no great pains, according to those to describe the Motions of the Arteries; nor doth he think it very difficult, by use and exercise to come to know and to distinguish by Touch even the compound and discordant Pulses. In short, to make our selves Masters in this skill, he would have us to labour so long in exploring the nature of mens Pulses, till they become so well known and so familiar to us, as a Harp or Lute is to the Players thereon; it not being enough for them to know, that there is something amiss which spoileth the tune, but they must also know what String it is which causeth that Fault.

On this occasion the *Publisher* thinks it will not displease the Reader here to give him notice, that he lately saw a letter written from *Java* in the East-Indies, mentioning an Indian Treatise, much discoursed of, Concerning the *Art and Method of knowing Diseases and their Events by the Sole beating of*
the

the Pulse: And that some Curious persons in that Island had already written to some Religious men in *China*, desiring them to spare no pains in procuring it: To promote which, a sum of money had been a while ago sent thither for a reward to the Translators. Further, that those Persons in *China* had promised to imploy all their interest there of doing the thing, as that, which exceedingly tends to the relief of mans health and the Comfort of their Life.

9. The Contemptibleness of the Modern way of Musick, which to him is such, that he saith, there is hardly so much as the shadow of the Pristine Majesty of it remaining; wondering that those, who in this and the former age have written of Musick, have written nothing of the *Rythme*, or have done it so, that they seem to have been altogether ignorant of what it is; regarding nothing but to please the Ear: Whereas, to affect the mind, 'tis necessary the sound should signifie what may be understood by the mind, without which there can be raised no true pleasure, nor any strong affection. In a word, he affirms, that if without partiality we compare the Ancient Musick with the Modern, and consider the Effects of both, we must either acknowledge the ignorance of the Modern Musicians, or evince to be false what the Ancients have delivered of the power and efficacy of their Musick.

10. The Excellency of the *Chinese* Musick, though that people doe complain of the loss of their antient way of Singing, which if they doe Justly, our Author scruples not to affirm, that their Musick must have been divine, seeing the remainders of it are so excellent, that they may easily silence all the Musick of Europe.

11. The rare contrivance for rendring even and strong sounds, of the Old Roman *Hydraulick Organ*, described by *Hero* and *Vitruvius*, and explained by our Author, and by him declared to excel our Organs, yielding an unequal and weak blast.

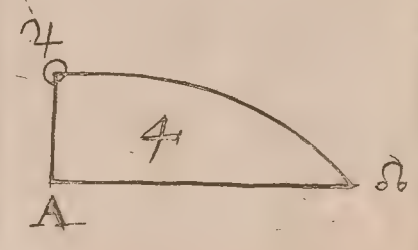
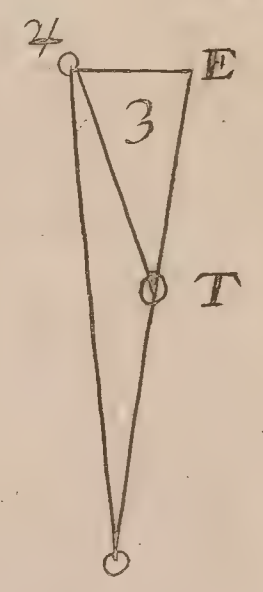
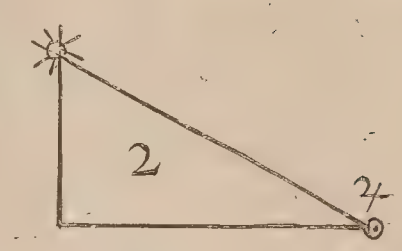
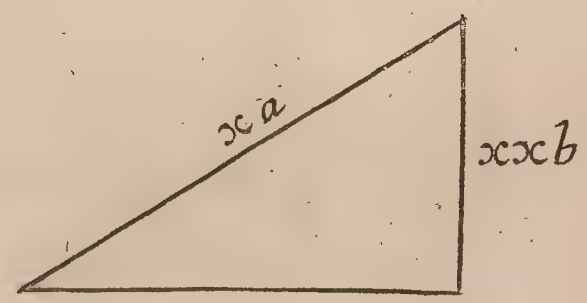
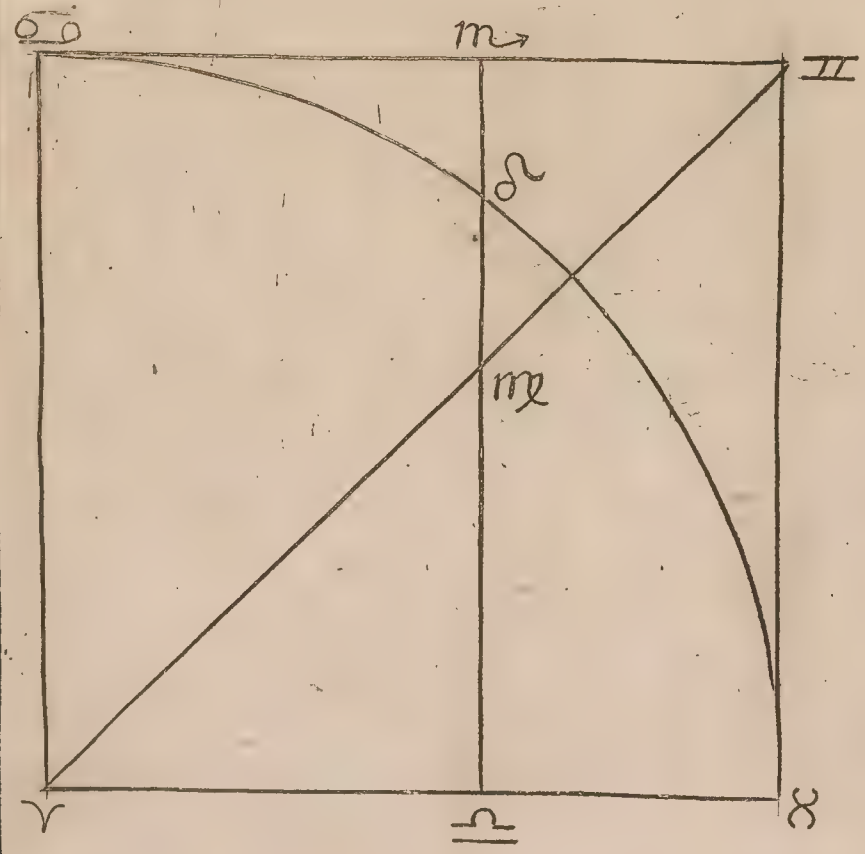
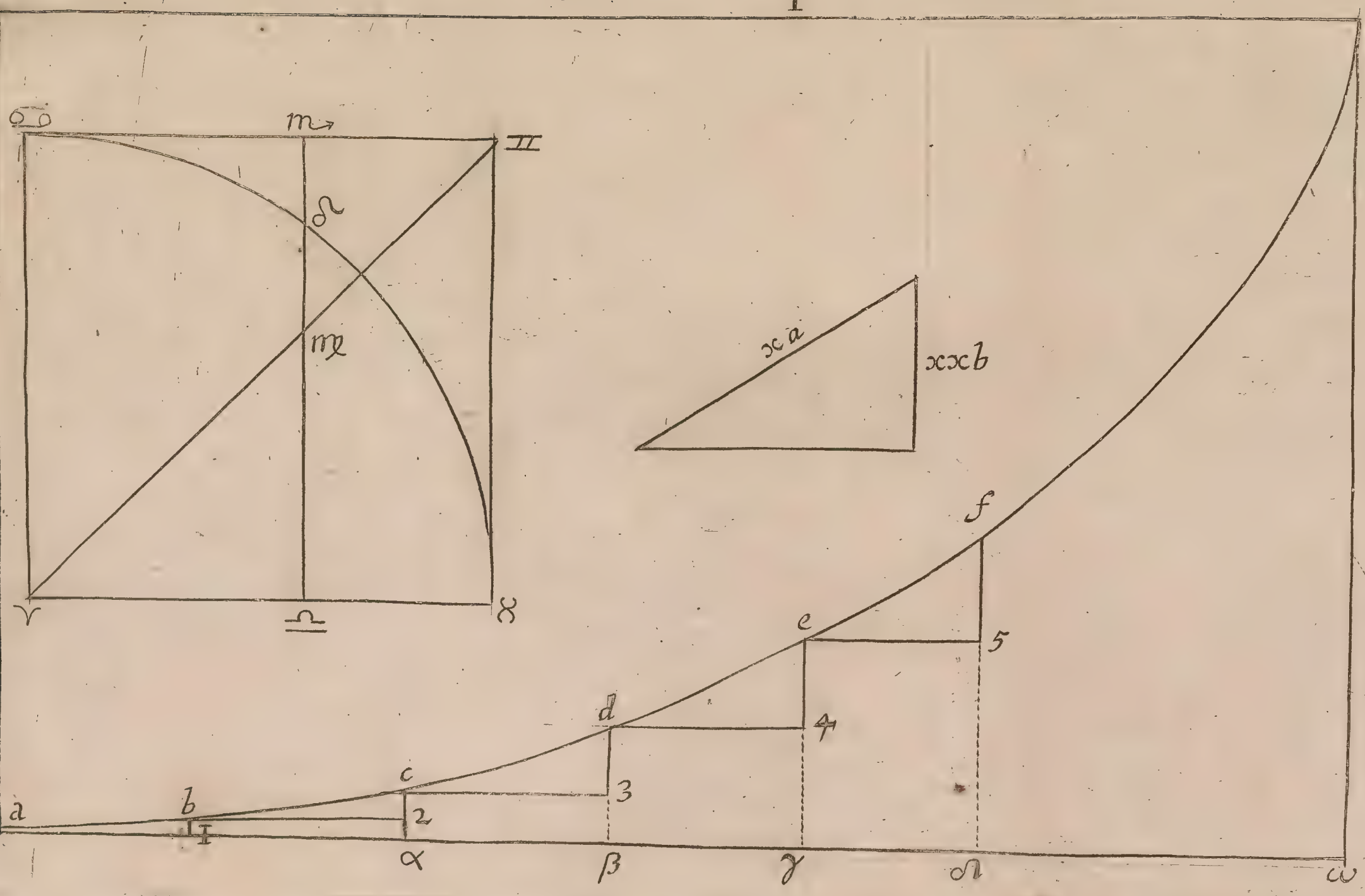
12. The Art of the Ancients of making such *Tibia* or Pipes of so many different forms and figures, as there are kinds of affections, concerning which he affirms, that there is none to be found this day, that do so much as know, how to make such
Pipes

Pipes that are able to produce such motions; Since our modern Artificers, in his opinion, do fail not only in the matter, of which those instruments are to be made, but also in the proportion, which is to be observed in their form: Forasmuch as 'tis now commonly thought, that, there being two *Tibiae* of the same length, but of different thickness, the thicker of the two will yield a graver sound than the slenderer; which he saith, is contrary to Experiment; by which he alledges to have found, that the thicker the *Tibiae* are, the acuter sound they yield, and the slenderer, the graver, provided you keep the same length. Where he undertaketh to correct *Galileus* and *Des-Cartes* concerning this particular. He concludes all with this admonition, that if any have a mind to restore the Antient Musick, or to rectify the Modern, he must by all means imitate the diligence of the Antients in reducing all syllables to a certain quantity, and in restoring Metrical Feet, which, he saith, the Modern Musick is almost altogether destitute of.

LONDON,
Printed for John Martin, Printer to the Royal Society. 1673.

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I





PHILOSOPHICAL TRANSACTIONS.

May 19. 1673.

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A Demonstration of the Synchronisme of the Vibrations made in a Cycloid, given by a Person of Quality. An Extract of Mr. Flamsteeds Letter, containing some more accurate Observations of Jupiter, useful for determining that Planets Inclination to the Ecliptique. A Specimen of some Microscopical Observations lately made in Holland. An Extract of a Letter from M. Denys, giving notice of an admirable Liquor, instantly stopping the Blood of Arteries prickt or cut, without any suppuration, or without leaving any scar or cicatrice. A Description of the Uses of a certain Powder for yielding a very close and smooth Metall, and of easier carriage, &c. Extracts of two Letters of Dr. Swamerdam, concerning some Animals that having Lungs are yet found to be without the Arterious Vein; together with some other curious particulars. An Account of some Books: I. LA STATIQUE, ou la Science des Forces Mouvanter; par le P. Ignace Gaston Pardies. II. Antonii le Grand HISTORIA NATURÆ. III. The Description and Use of two ARITHMETICK INSTRUMENTS; together with a short Treatise, explaining and demonstrating the Ordinary Operations of Arithmetick; as likewise a Perpetual Almanack, and several Useful Tables; by S. Moreland. IV. A Brief Account of some Travels in Hungaria, Servia, Bulgari, Maccedonia, &c. by Edward Brown M.D.

Nobilissimi cujusdam Angli Demonstratio Synchronismi Vibrationum peractarum in *Cycloide*; nunc juris publici facta ex occasione quam suppeditavit Rev. P. Pardies, de eodem Argumento Demonstrationem exhibens ad calcem libelli nuper ab ipso Gallicè editi de *Statica*, inferiùs à nobis commemorandi.

Sint $ab, bc, cd, de, ef, \&c.$ omnes invicem æquales; & $b_1, c_2, d_3, e_4, f_5, \&c.$ equaliter crescant ut 1, 3, 5, 7, 9, &c.

Dico, in hac Linea Grave quodlibet, cadens ex quovis ejus puncto, attingere fundum in eodem temporis spatio, quo eum attingeret si caderet ex quovis ejusdem puncto alio.

Nam si ponas $a = ab = bc = cd \&c.$ & $b = b_1$, & x pro quolibet numero alterutrorum; tunc, si xa ponatur pro af , xxb representet oportet fd , proindeque tempus descensûs necessario erit $\frac{xxb}{xxa} \text{ seu } \frac{b}{a}$; atque idem in omnibus obtinet casibus. Ergo, &c.

Dico insuper, Curvam hanc esse Cycloidem. quod demonstratum est facile ex Constructione, atque ex eo quod jam innuo; nempe, Curvam hanc $abcdefz$ æquare duplum ultimæ rectarum, $h. e. 2z\omega$, & $a\omega$ æqualem esse semi-circumferentiæ Circuli cujus $z\omega$ est diameter; ac universim Triangulum $V\delta\Pi$ representare rectam $z\omega$; & Quadratum $V\delta\Pi\Xi$, Curvam $abcdefz$, & Quadrantem $V\delta\Xi$ representare rectam $a\omega$: ac partes unius, partes alterius respectivè. Ut si $V\Xi\Pi$ representat fd , tunc $V\Xi\Omega$ representat ad , & $V\Xi m$ representat af . At non vacat fusiùs hæc prosequi.

Dico deniq; (justæ longitudinis) Globulum suspensum è funiculo, & intra duas Cycloides vibrantem, moveri in Cycloide. Quare Vibrationes ejusmodi sunt synchronæ. quod erat &c.

An Extract of Mr. Flamsteeds Letter of April. 19. 1673. containing some more accurate Observations of his own, about Jupiter's Transits near some Fixed Stars; useful for determining the Inclination of that Planet to the Ecliptique.

SIR,

THE inclosed Paper contains some Observations of Jupiter, which being made from a more convenient Station, than I commonly have used, are more accurate than my former ones: And, the Planet being in a fit place of his Orbit, they are the most useful for determining his *Inclination* to the *Ecliptique*, that we can again expect this six years, or perhaps before he returns again to this place. Had the Latitudes of the Fix'd Stars of *Tycho's* constitution been exact and coherent, we should easily have determined the *precise* quantity of this Inclination and those regular Inequalities we find in this and in all the other Planets, which are found irrepresentable by numbers, only by reason of some latent errors in the Places and Latitudes of the Fixed.

It would be a task deserving the pains and accuracy of the Learned *Cassini*, and of all others that have good Observatories and Instruments, to endeavour the Restoring of the Fix'd Stars, especially of those that are near the *Ecliptique*. Had I only a convenient place for observing, a ready Assistant, and other necessary accommodations, I should not doubt in a few nights to rectifie many of *Tycho's* errors; and to add some Stars to his Catalogue, as well visible to the bare eye, (yet omitted,) as Telescopical ones.

I have made lately some Observations of the utmost Elongations of the three Inmost *Satellites*; which I find greater than Signor *Cassini* states them, but almost the very same with Mr. *Townley's*. But I have just cause to suspect some Excentricity in the *third*; for I find (except I mistook in my measures, which, I think, I could not possibly do,) its Elongation greater on the one hand of Jupiter than on the other. I intend, at another opportunity, to make more Tryals as carefully as I can, either to confirm or destroy this observation.

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Ob-

Observationes ipsæ Joh. Flamstedii.

Quas tibi Jovis, prope Fixas transeuntis, observationes jam antea, Clarissime Oldenburgi, impertii, ejus in Tabulis motus fieri tardiores quàm in cœlis, (quod & Horroccio pridem suboluerat,) evidentissimè ostenderint: Latitudines etiam observatæ, minores semper supputatis, vel satis non promotum Nodi locum, vel justo latiore Plani orbitæ Jovialis inclinationem constitutam, videbantur innuere. Nodum, numeris Rudolphinis promotiorem cœlitus poni, à suis se observationibus reperire scribit Clar. Cassinus: Orbitæ minorem esse aliquantulum inclinationem ad Eclipticam, quàm statuit Keplerus (si Fixarum latitudinibus, in catalogo Tychonica exaratis, fidendum est,) ab observationibus infra descriptis ostendam.

Anno instanti 1673. Martii 13. st. Jul. vesperi, Jupiter Aphelius, pronus ad phasim Acronicam, & limitem orbitæ Boreum paululum transgressus, Retrogradus incessit versùs 9am m^{is} lucis 4^{ta}, è qua (alto eo sex circiter gradus) limbi ejus remotissimi distantiam, septempedali tubo & micrometro Townleiano cepi $4560 = 52' - 34''$.

Martii 17 die D^{ra}, circa hora dimidiam post exortum Jovis, ejus, eodem tubo, limbi remotissimi à Fixa cepi iterum distantiam $2073 = 23' - 54''$.

Martii 20. die 4^{ta}, è loco multum commodiori, sequentes habui observationes. Primam breviori tubo, digitorum tantum 85, reliquas longiori, videl. 164. dig. V. Fig. 2.

	Fix. alt.	hor. sup			Limbi. ph.	Centri.
	o	h				
1	6 — 0	7 — 14	Limbi 4 ^{is} remotioris à Fixa distantia —	850	9 — 48	9 — 24
2	. . . . .	. . . . .	Eadem distantia tubo majori capta —	1650	9 — 52	9 — 28
3	14 — 40	8 — 16	Limbus 4 ^{is} infimus depressior ac fixa —	784	4 — 41	4 — 17
4	15 — 40	8 — 23	Altitudinum eadem repetita differentia —	786	4 — 41	4 — 17
5	. . . . .	. . . . .	Jovis diameter —	1350	0 — 48	
6	16 — 25	8 — 29	Limborum iterum capta distantia —	1665	9 — 57	9 — 33
7	. . . . .	. . . . .	Denuo —	1658	9 — 54	9 — 30
8	19 — 00	8 — 50	Differentia altitudinum limbi 4 ^{is} & Fixæ —	838	5 — 00	4 — 36

Inde ad diem 26. nubes & pluvia, continua ferè, Jovis omnem observationem prohibere; hujus tamen vesperi, cœlo præter spem facto sereno, alto 4^{to}. 15° — 40', limbi sui remotioris à Fixa distantiam, eodem minori tubo, dimensus sum $4205 = 48' . 30''$.

Nocte etiam proximâ sequente, Jovem à Fixa plus remotum vidi; sed accuratè metiri distantiam, nubium, cœli locum subtercurrentium, spissities, hand permisit.

Ad Planeta locum ex his annotationibus eliciendum, structis supputationibus, invenio

	h.		h.
	hor.	8 16	hora 8—50
Angulum parallacticum	34—44	37—30	
Centrum ψ^{vis} à Fixa distat	9—28	9—30	
Altitudinum differentia erat	4—17	4—36	
Ergo, Angulus erat positionis	80—06	78—21	
Et Jupiter in antecedentia Fixæ	1—38	1—55	
cum latitudine minori	9—19 $\frac{1}{2}$	9—18	

Fixæ mihi locus, accepto motu annuo 50", erit $\approx 13^{\circ}-37'-11''$; quem vult author Carolinus $13^{\circ}-33'-47''$; latitudo ejus Borea $1^{\circ}-45'$: Locus ergo verus Jovis erit mihi,

Hora	8—16	\approx	13—35—33	} Latitudo vera	{	1—35—40 $\frac{1}{2}$
	8—50	\approx	13—35—16			1—35—42.

X^a 117.

X^a 117.

Jovis tunc locus in Ephemeride Heckeri est $\approx 13-22$, justo minor, scilicet 14' min. Motus retrogradus est 8' min. Propterea scrupulis hora 34' recesserit Planeta scrupulos secundos 11" fere; nostra observatio dat 17"; quæ exigua differentia ejus præcisionem admodum commendat.

At Fixæ concesso loco Carolino, prodibit ψ^{vis} locus $\approx 13^{\circ}-32'-09''$. qui ab istis Tabulis eruitur $13^{\circ}-27'-32''$, à cælis suis deficiens 4' 37" latitudo ab iis supputata reperietur $1^{\circ}-37'-21''$, cælos exsuperans 1' 41".

Loco sic Planete cum latitudine, & Tabularum à cælis deviationibus perceptis, ne commodissima observationis ulteriorem summumque fructum perdamus, Orbitæ Jovialis ad Terrestris orbitæ Planum inclinationem inde eruere conabimur.

Huic equidem inveniende, unà cum loco Solis, ejusdem, Jovis, & Terræ intermutuæ distantie postulantur: quas à Tabulis quibuscvis probatioribus tutissime haurire licet: Ego Tabulis utor plerumque Carolinis; quippe quas, utut nonnunquam deviantes, cælorum motibus propius annuentes, accuratiores, & faciliores cæteris omnibus comperi, ex quibus ad 8 h. — 16' p.m. deprompsi;

Solis locum verum $\approx 10^{\circ}-40'-18''$.

distantiā à Terra ————— 100084

Jovis à Sole distantiam ————— 544921

à Terra ————— 444952

Jam in apposita figura 3. sint, S Sol, T Terra, ψ Planeta, S E Radius Eclipticæ, ad ψ^{vis} orbitam protensa, & angulus ψ T S, visa Planeta à Terra Latitudo $1^{\circ}-35'-40'\frac{1}{2}$.

Ex datis (in triangulo ψ S T) angulo, ψ T S, visa latitudinis ad Circulum complemento; ψ S, & ψ T, Planeta à Sole & Terra distantis, ut supra, repertis, eruetur angulus ψ S E, latitudo sive Inclinatione Planeta à Sole inspecta, 1^o. 18'. 7.

Jovis.

Jovis locus Geo-centricus erat $\approx 13^{\circ}.35'.33''$; ab iis ergò datis 4° & Terra à Sole distantis, invenietur locus Helio-centricus planetae $\approx 13^{\circ}.03'.33''$; è quo subductis sigillatim iis nodi locis, quos autores, quorum nomina in sequenti tabella exaravimus, assumpserunt, annexa produnt argumenta Latitudinis; è quibus videre est, nullis plus Jovem à limite promotorum haberi quàm $6^{\circ}.29'.56''$, nec minus quàm $3^{\circ}.58'.59''$, quæ quantavis videtur differentia, in maxima orbitæ inclinatione investiganda, errorem scrupulis secundis $23''$ majorem inferre nequit.

Authores	Loca	Argumenta latitudinis
Keplerus	3-06-33-37	3-06-29-56
Streetius	3-06-33-47	3-06-29-46
Wingius	3-07-11-39	3-05-21-54
Ricciolus	3-07-18-00	3-05-45-33
Cassinus	3-08-45-00	3-04-18-33
Bullialdus	3-09-04-34	3-03-58-59

ampli aliquantulum justo promotior videtur, magis tamen ceteris, variis de causis, placet: sumptis propterea, in Triangulo $\triangle A \delta$, argumento latitudinis $\delta A 94^{\circ}.18'.33''$, & inclinatione $\triangle A 1^{\circ}.18'.07''$, eruetur Angulus inclinationis plani orbitæ Jovialis ad Eclipticam $1^{\circ}.18'.20''$; quem statuunt Keplerus $1^{\circ}.19'.00''$, Streetius $1^{\circ}.20'.00''$. Bullialdus & Wingius $1^{\circ}.21'.48''$; omnes, justo nonnihil majorem. V. Fig. 4.

Tantamque esse inclinationem, vel saltem non majorem, cum hesternæ noctis, tum Mensum Februarii, Martii & Maii Anni elapsi observationes suadent. Interea verò non dissimulandum, posse & majorem (scilicet $1^{\circ}.20'.20''$) à transitu 4° prope 8^{m} m^{is}, Anno 1649. Maii 29 & 30, St. Juliano, Bononiæ & Majorcæ à Ricciolo * &

* Vid. Almag. Novum part. 1. pag. 710.

Muto, viris doctissimis, observato, demonstrari: id quod nobis (si quidem orbitarum inclinationes ab omnibus invariabiles habentur,) videtur innuere, errorem vel huic, vel illis Fixarum latitudinibus à Tycho assignatis, inesse aliquem: quæ propterea donec accuratius restituantur, à præcisa hujus Inclinationis quantitate determinanda meritò nos arcet: Hoc tantùm, quoniam fixarum eæ latitudines etiam immutabiles reperiuntur, ausim affirmare; Angulum maximæ inclinationis plani orbitæ Jovialis ad Eclipticam minorem esse scrupulis $26'.40''$ quam latitudo stellæ 9^{a} m^{is} lucis 4^{a} , quæ Tycho dicitur, ultima quatuor in sinistra ala Virginis: quæ propterea si quando correctæ dabitur, eadem certa dabitur inclinatio.

Verbiæ, Apr. 16.

1673.

J. F.

A Specimen of some Observations made by a Microscope, contrived by M. Leewenhoeck in Holland, lately communicated by Dr. Regnerus de Graaf.

THE person communicating these Observations, by and by to be delivered, mentions in a Letter of his, written from *Delft* April. 28. 1673. that one Mr. *Leewenhoeck* hath lately contrived Microscopes excelling those that have been hitherto made by *Eustachio Divini* and others; adding, that he hath given a specimen of their excellency by divers Observations, and is ready to receive difficult tasks for more, if the Curious here shall please to send him such: Which they are not like to be wanting in.

The Observations themselves.

1. The *Mould* upon skin, flesh, or other things, hath been by some represented to be shoot out in the form of the stalks of Vegetables, so as that some of those stalks appeared with round knobs at the end, some with blossom-like leaves. But I do observe such Mould to shoot up first with a straight transparent stalk, in which stalk is driven up a globous substance, which for the most part places it self at the top of the stalk, and is follow'd by another globul, driving out the first either side-ways, or at the top, and that is succeeded by a third and more such globuls; all which make up at last one great knob on the stalk, an hundred times thicker than the stalk it self. And this knob indeed consists of nothing else than of many small roundish knobs, which being multiplied, the big knob begins to burst afunder, and then represents a kind of Blossoms with Leaves.

2. The *Sting* of a Bee I find to be of another make than it hath been described by others. For I have observed in it two other stings, that are lodged within the thickness of the first sting, each having its peculiar sheath.

3. Further

3. Further I observe, on the Head of a Bee before, two *artus* or limbs with *teeth*, which I call *Scrapers*, conceiving them to be the organs wherewith the Bee scrapes the Waxy substance from the Plant. Besides, I find two other limbs, each having two Joints, which I call *Arms*, wherewith I believe this Insect performs its work and maketh the Combs. Moreover, there is also a little Body, which I call the *Wiper*, being rough and exceeding the other Limbs in thickness and length, by which I am apt to believe the Bee wipes the Hony-substance from the Plant. All which *five* Limbs the Bee, when she doth not work, knows curiously to lay by close under her head, in very good order.

4. As to the *Eye* of the Bee, which I have taken out of the Head, exposing its innermost part to the Microscope; I find, that the Bee receives her light Just with the same shadow as we see the Hony-combs: Whence I am prone to collect, that the Bee works not by art or knowledge, but only after the pattern of the light received in the Eye.

5. In a *Lowse* I observe indeed, as others have done, a short tapering Nose with an hole in it, out of which that Insect, when it will draw food, thrusts its sting, which, to my Eye, was at least five and twenty times less than one single Hair. But I find the head every where else very close round about, and without any such sutures as some have represented it. The Skin of the head is rough, resembling a skin that hath many dints in it. In the two Horns I find *five* Joints; others having marked but *four*. One Claw of her foot is of the structure of that of an Eagles, but the other of the same foot stands out straight, and is very small; and between these two claws there is a raised part or knob, the better to clasp and hold fast the hair.

So far this Observer: who doubtless will proceed in making and imparting more Observations, the better to evince the goodness of these his Glasses.

Extract of a Letter, written to the Publisher by M. Denys from Paris, May 1. 1673; giving notice of an admirable Liquor, instantly stopping the Blood of Arteries prickt or cut, without any suppuration, or without leaving any scar or cicatrice.

SIR,

WE are now busie, by the King's order, in making Experiments, whence the world is like to receive great benefit. 'Tis needless to prepare you for it by putting you in mind of the difficulty there is in stopping the Blood of Arteries, prickt or cut. Meantime here hath been found out an admirable Essence, which being applied to any Artery whatsoever, stops the blood instantly without any need of binding up the wound. We have first experimented it upon Dogs, of whom we cut the Crural and Carotid arteries and the Thigh it self; and the blood stopp'd in less time than needs to read this Letter. 'Tis a remedy which is not corrosive; the wound healing without any scar, suppuration, or cicatrice.

We have also made Tryals upon Men, of whom the Temporal arteries were open'd; and upon others, whose hands and face had been cut: And it succeeded with them as well as it did upon dogs.

You may judge, how useful this Essence is like to prove in Armies, where most men dye for want of a good remedy to stop the blood. This Liquor works not only outwardly, but also being taken inwardly; for it stops the Loss of blood *in feminis*, Inveterate fluxes of blood, open Hemorrhoides, and other Hemorrhagies.

Now that this Remedy hath been well tryed in the presence of all the Court, and of many of our best Physitians and Chirurgeons, that have admired it; the King hath given a privilege to sell it in his Armies and throughout the whole Kingdom.

So far this Letter; which being confirmed by those of two others, persons of good credit, of the same place, hath induced the Publisher to desire one of them to send him some of this Essence for tryal.

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A Description of the Uses of a certain Powder for yielding very smooth and close Mettal, and of easier carriage, &c.

THis was lately communicated to the Publisher by a German Physician residing at *Frankfort on the Mayne*, in High-Dutch; the English of which is as follows;

1. The Powder, I speak of, maketh the Mettal so close and smooth, that it leaves not the least pit in the piece, and that a Gun so cast needs no boaring.

2. One third of the Mettal may be spared.

3. Such Guns remain clean and neat a long while. In the Year 1672. July 9. there was cast a Demy-canon; weighing 34 hundreds of weight. This being tryed with a bullet of 34 pounds weight, there was employed the first time 12 pounds of powder, the second time as much, the third time 15 pounds, and the fourth time 24 pounds, strong powder; all which tryals it endured very well. Besides, not long since there was cast a small Petard of only two pounds of this mettal, with which I broke in pieces a beam of a Rhine-foot square, the Petard remaining entire and perfect.

When you have occasion to carry these pieces over land, you shall not need so many horses by far as otherwise. And in great Ships and Galleons, that are sometimes mounted with 100 Guns each, you may of the matter of 200 make 300 Guns, performing the same, if not a better, effect. If his Majesty be pleased to command a *Specimen* of this Powder for a good tryal, we are ready to send it. It is not only easie to make, but also of small expence.

Extracts of two Letters of Dr. Swammerdam, concerning some Animals, that having Lungs are yet found to be without the Arterious Vein; together with some other curious particulars.

WE shall give the Reader both these Extracts in the same Language the Letters were written in. The first was written *Jannar. 24. 1673. at Amsterdam, viz;*

— *In nuperis meis Sectionibus Animalia quædam deprehendi, quibus, licet uterentur Pulmonibus, Vena tamen Arteriosa fuerit à Natura denegata; sic ut sanguis immediate è corde, præviâ nullam in pulmonibus Circulationem aut conquassationem passus, per totum corpus distribueretur: quæ Observatio Anatomiam comparatam quàm maximè commendat.*

Scarabæi nasi-cornis genitalia, quoad vasa testicularia, ad æmulum cum humanis convenire testiculis, atque ex unico tantum funiculo, longo, cavo, innumerabiliter flexo, atque (quod nondum in homine mihi visum,) principio seu apice cæco, constare, non sine aliquo stupore lustravi: Ut jam nullibi non manifesta sint divinæ sapientiæ & summi in abjectissimis animalibus artificii vestigiâ.

Thus He in his first Letter: whereupon being desired to nominate those Animals, that are destitute of the *Vena Arteriosa*, he very obligingly sent, in a second Letter dated March 14. 1673. at Amsterdam, the following Observations.

— *Cùm videam, Societati Regiæ meas non displicere operas, æquo illius desiderio è vestigio obtemperare volui; eoq; libentius, ut aliis etiam in rem adeò notabilem inquirendi ansa daretur, proindeque Naturæ abdita eò citiùs manifestarentur.*

Nemo, opinor, Ranis pulmones denegabit, postquam Exercitissimus Malpighius tam curiosa tamq; notabilia de iis divulgavit, atque Solertissimus Gualterus Needham pulmone manifesto eas donari atque respirare annotavit. In his tamen Amphibiis Vena arteriosa desideratur: Quare nec eorum sanguis ullo modo per Pulmones circulatur, in iisvè cribratur, verberatur aut comminuitur; cùm mox ex simplici eorum cordis sinu per totum corpus, pulmonibus intactis relictisque, dispescatur. Quod certè haud debile mihi argumentum videtur, quo, inter alia, Hepati suum Sanguificationis munus, restituere aliquando conabor.

Arteria tamen manifesta (bronchiali, seu potius pulmonali analogâ) in Ranarum pulmonum succingente tunica adest, quæ mirandum in modum, ac retis mirabilis ad instar, per eorum superficiem tenditur, atque minutissimis suis propaginibus sensim ad interiores Vesiculas progreditur; ubi, (ut Ego quidem arbitror,) cum Vena pulmonali Anastomosis patitur, etiam oculis manifestam. Venosum illud vas Arterioso duplo majus: In Pulmonum cavo,

ac præcipuè in Vesicularum ejus oris ac limbis situm est, à quo omnibus cellulis, imò & ipsi tunica succingenti, capillaribus ac ferè invisibilibus ramusculis prospicit.

Animalia, quæ suspicor eandem cum Ranis Pulmonis structuram obtinere, sunt Bufones, Lacertæ, Serpentes, Chamæleontes, Testudines, Salamandræ aquaticæ, & si quæ sunt alia pulmonibus Membranosis instructa; quorum structuram mihi nondum licuit perquirere. Suffecerit jam indicasse animalia, Virisque me longè sagacioribus viam monstrasse.

Cùm videam vobis grata fuisse, quæ de Nesi-cornis Scarabæi genitalibus nota veram, non alienum fore duxi eorum delineationem Cl. Tuæ transmittere; in qua imprimis exhibentur non modò Testiculi ex unico funiculo, duos pedes & sex pollices longo; sed & Vasa Deferentia, semen copiosum ac album, quando leduntur, stillantia; nec non vesiculæ seu potius glandulæ seminales sex, admodum elegantes; glandularumq; seminalium ductus protensi, materiam seminalem sub-flavam (ut in hominibus ac brutis quoq; observatur) continentes.

An Accompt of some Books.

I. *LA STATIQUE, ou La Science des Forces Mouvantes*, par le P. Ignace Gaston Pardies, de la Compagnie de Jesus. A Paris, 1673. in 12°.

THE Learned Author of this Book had proposed to himself to write a whole Body of *Mechanicks*, such an one, as might be accommodate to ordinary Capacities; he conceiving, that there had not been extant hitherto a compleat system of that Science, or, if there had, it did exceed the reach of most Readers: which latter he thinks to be the Character due to Dr. Wallis his Three Tomes de *Motu & Mechanice*, of which we gave an Account N°. 54. p. 1086. N°. 61. p. 2005. N°. 76. p. 2286.

But since the publication of this part of it, we understand that he hath been prevented and cut off by an intemely Death; being regretted by those that knew his frankness and strong inclinations to promote philosophical knowledge. How far he hath indeed advanced those other parts of this Design, and, whe-

whether those of his Society, in case he hath made a good progress therein, will take care to see it publisht, we know not; but yet hope, He hath gone a good way therein, and, if so, that his Companions will not suppress his labors, for the benefit of young Students in this kind of knowledge.

Concerning the *whole Design*, the Author (as appears by the *Preface* to this part of it) had so contrived it as to make it up of *Six* parts.

The *first* is of *Local motion*, already published by him, though he thought not fit to prefix his Name to that part, in the year 1670. in *French*, and *English* the same year; described in *Numb. 65. p. 2010.*

The *second* is this very Discourse, entituled as above; which treats of such Motions, as are performed with Violence, by surmounting the Resistance that is made from elsewhere. Here, besides the Demonstration given of all those Moving Engins, whose force may be reduced to that of the *Ballance*, some reflexion is made on the Impossibility of the *Perpetual Motion*. Besides, the Author treats of Bodies suspended, fastned at one or both Ends; of the manner how they are broken; of the figure they take in becoming curve; and particularly of the *Cases*, where Cords extended will be Parabolical, Hyperbolical, Elliptical, or Circular. More-over, he examines the force of Towers and Pyramids, and shews in what part they are weakest; he determines the figures they ought to have to render them perfect and able every where to resist equally to the violence of Winds; delivers General Rules of the Resistance of bodies, and teaches the way of applying those general rules to particular cases, relating to Architecture and other effects of Nature and Art: And taking an Example of the motion of a *Ship*, he observeth the use that may be made therein of the Rules of Mechanicks.

By the by, having made mention in the *Preface* of the uniform motion in a *Cycloid*, he gives us his way of demonstrating this Uniformity, to see, whether, when M. *Hugens* shall have publisht his demonstration, he be so fortunate as to concur with him in it.

As for the other *four* parts, (which his Death, 'tis feared, will

will deprive us of,) they should have contained, as he intimates in the same *Preface*, the following particulars :

The *first* of them, the Motion of *Heavy* bodies; shewing all the proprieties of this motion, whether it be that the Bodies descend by their own weight, or are mov'd by some pulsion of violence. Where he would give the reason of that admirable augmentation and diminution of the Celerity of bodies, that pass in their ascent and descent through all the imaginable degrees of Tardity. On which occasion he would have discoursed, that *Galilei* hath not shew'd those proprieties but by supposing a Definition which is contested; and that *Baliani* undertook to give an other Progression to the Motion of those Bodies. Which two Authors having had their respective abettors, and whole Volumes of contestations having been written about it between *Gassendus* and *Cazre*, the whole business seemed to have been determined by three great Geometricians; *M. Hugen*s and the *P. de Billy* having demonstrated, that the Progression of *Baliani* was impossible; and *M. Fermat* having shew'd, that there would need no less than a whole eternity for a Body that should, with this proportion of celerity, descend the height of one only foot. Whereupon the Learned seemed to have yielded to such regular demonstrations: But it appears, that *P. Lalouvera* survening made it out, that notwithstanding all those demonstrations, the Progression of *Baliani* was very possible and very natural; the manner wherewith he maintained it, having appeared so fair, that *M. Fermat* himself was never able to gainsay it. All which the Author would have delivered in this *first* of the *four* remaining parts, and shew'd, that that first weight, or that determined degree of celerity, on which *Lalouvera's* demonstration is grounded, cannot subsist. Where also should have been explained, not only a Progression altogether like it, found in the Motion of an Arm or Foot, or of Instruments which we hold when we strike; but also another kind of Progression, such as we find in Canon-bullets, or in Arrows shot with a Cross-bow. To all which he would have added in the same part an examination of the motion made upon *Inclined* Superficies; where would have occur'd the demonstration, made also by
M.

M. *Hugens*, of that important proposition, touching the motion made in a Cycloid.

The *second* of them, would have consisted of the Motion of *Liquids*; where he would not only have demonstrated all the *phenomena* of the Celerity of Liquors, of the Force of their Pressure, of the Direction and Figure they take in their Jets, Course, and Equal Poise; but also comprehended the whole Science of *Pneumatiques*, (since Air is a liquid;) the force of Springs, Rarefaction and Condensation, and the strange Violence of Gun-powder kindled, and all the new Experiments of the *Vacuum*, and the reason of all those surprising Effects observed in them.

The *third* would have treated of the motion of *Vibration*, Where he would have described a *Pendulum* having all its vibrations synchronous, together with a demonstration, *that* all Vibrations of a cord extended do last equally long; *that* the Vibrations of two cords of an equal thickness and tension are in a reciprocal proportion of the Length of the cords, whereas in *Pendulums* they are only in a sub-duplicate proportion; *that* in equal cords the Vibrations are in a sub-duplicate proportion of the forces or weights that make them tense; *that* the Vibrations are likewise in a sub-duplicate proportion of the thickness of the cords equally long and equally tense. And so he would have demonstrated by the Causes, what ever hath been observed by Experience in Sounds and in the Harmony of tense Bodies.

The *fourth* would have discoursed of the Motion of *Undulation*, taking for an Example those Circles that are made on the surface of the water upon the throwing in of a stone. Where also would have been considered some Circles like the former, such as may be formed in the Air, and even in some other more subtile Bodies, which manifest experiments evince to be spread every-where. And of such Circles he would have examined, how they may be formed, how their motion is communicated, what are the lines of their direction, with what force they may act near or far off, how they may reflect and refract. Further, supposing that *Sound* hath for its vehicle this kind of motion in the Air, he would have explained all
what

what concerns *Sounds*; and making a Conjecture about the propagation of *Light*, he would have discussed, whether it might not be supposed, that *Light* hath for its vehicle some such motion in an Air more subtile; and shew'd, that indeed in this *Hypothesis* all the proprieties of *Light* and *Colours* might be explicated in a very natural way, without which it would not be done but with great difficulty.

This is the whole Design, drawn up by the Author; in which he intended, as he saith in this piece, to have interspersed divers curious and useful practises of Art, and many demonstrations giving light for the decision of several considerable Questions in Natural Philosophy.

II. *Antonii le Grand HISTORIA NATURÆ. Londini, apud J. Martyn, R. Societ. Typographum, ad Insigne Campanæ in Cæmeterio D. Pauli, A. 1673. in 8°.*

THE Learned Author of this Book, desirous to shew, that even the common and obvious *phenomena* of Nature can be very congruously explained and accounted for by those Principles he hath formerly laid down, and published A. 1672. under the Title of *Institutio Philosophiæ*, described in Numb. 80. of these Tracts; maketh it his business in this Treatise, to pass, for that purpose, through the whole Body of Physiology, and in so doing to supply in due places what he hath omitted in the said Institution.

This he performeth in Nine several parts, into which he thought fit to divide his Book;

In the *first* of which he treats of the Nature of *Bodies* in general: Where he endeavors, to disprove all Vacuity in Bodies; to refute the Arguments and Experiments alledged to assert a vacuum; and to explain the Proprieties and Affections of Bodies, as Indefinit Divisibility, Rarity and Density, Hardness and Fluidity, Roughness and Smoothness, Perspicuity and Opacity; alledging various Experiments concerning all these, and assigning Reasons for them.

In the *Second*, he undertaketh to explain the true Nature of the *Qualities* of Bodies by Experiments, and to make it out

out, that even those, that are commonly called *Occult*, may be explicated by Motion, Figure, Pores and Texture: where he discourseth at large of Heat, Cold, Gravity, Levity, Taste, Smell, Sound, Light, Colour, &c.

In the *third*, he delivers the History of the *Universe*, and particularly of the *Heavens*, and the Stars, Planets, Comets; together with his Opinion concerning their Influences upon the Bodies here below.

In the *fourth*, he dispatches the Explication of those *four great Masses* of the Sublunary World, the Earth, Water, Fire, and Air. About the *Earth* he examines its Position and Suspension in the Air, and its Magnetical vertue. Of the *Water*, he considers its proprieties, the Origin of Rivers and Fountains, and the Cause of the Flux and Reflux of the Sea. Of the *Fire*, he discourseth of its various Effects both above and under ground; Concluding this part with the Consideration of the great Power of the *Air* both in Natural and Artificial things.

In the *fifth*, he examines *Fossils*, Mettals, Fluors, Salts, Stones, delivering his opinion about their origine, and discoursing amply of the *Magnet* in particular, assigning with *Des-Cartes* the cause of the various *phenomena* thereof to be the passage of the *Materia striata* through the pores thereof.

In the *sixth*, he explains the doctrine of *Meteors*, Vapors, Exhalations, Winds, Rain, Hail, Snow, Dew, Thunder, Lightning, the Rainbow, &c.

In the *seventh*, he treateth of *Plants*, their variety, parts, qualities and vertues, vegetation, nutrition, decay, &c.

In the *eighth*, he giveth an account of *Animals*, of spontaneous and seminal generation, of the cause of Monsters, and of the different times observed in Animals for their bringing forth: To which he adds the various Affections of them, the Circulation of the Blood, Hunger and Thirst, Hatred and Love, Sleep and Waking, Infirmities and Diseases, &c.

In the *ninth* and last, he delivers the doctrine of *Man* in particular, adscribing to him, exclusively to Brutes, *Cogitation*, and asserting, that though Man, like other Animals, makes use of the like Organs of Sense with them, yet he doth not in that manner, as they do, perceive Objects, in regard that Sense in Man is *Cogitation*, which, in his judgment, belongs not to Brutes. Whereupon he gives here an account of divers Experiments about the Touch, Taste, Smell, Hearing and Seeing; treating afterwards of Imagination and Memory, and explicating also the Cause of Dreams, and of the Passions, Propensions and Aversions in Man.

III. *The Description and Use of Two ARITHMETICK INSTRUMENTS, &c.* By S. Moreland. Printed in London, 1673. in 12°.

THE Ingenious Author of this Book, having some years since contrived two Instruments, whereof the one is for Addition and Subtraction, the other, for Multiplication; gives us here *both* a Description of the parts and Structure of these Instruments, and the way and manner of Using them: affirming withall, that the latter of these Instruments alone is also of excellent Use in *Division*, as likewise in Extracting the Square, Cube, and Square-Square-Roots; and likewise that, if any Curious person will go to the Expence, the *Adding* Instrument, being Joyned to the *Multiplying*, performs all the four Species of Arithmetick, and the Extraction of the said Roots, without the help of Pen and Ink, or exposing the Operator to any difficulty or uncertainty.

But for the better understanding of these Instruments, he endeavours so to explain and demonstrate the reason of the Operations of the said four *Species*, and Extraction of Roots, as to render them plain and easie to the meanest capacities: Annexing thereunto, in short, the Doctrin of Proportions, Arithmetical, Geometrical, and Musical; as also the whole Intrigue of the *Golden Rule*:

Which done, he teaches, 1. The Diameter of any Circle being given in *Integers*, to find the *Periphery*, and the *Square-root* of the *Area*, in *infinitum*, without the help newly mention'd.

Next, he giveth us his *Perpetual Almanack*, together with an Explanation thereof, dividing that Almanack into three distinct Tables, which make the Use thereof obvious to all that shall take notice of his directions and exemplifications.

Further, he subjoineth a Table for the ready finding, what Sign the *Moon* is in, or shall be for ever, together with the Use thereof: As also a Table shewing the Time of the Moon's coming to the *South*, and Quantity of her shining; with directions how to use the same.

To these he adds a *Tyde-Table* and its Use, for certain Havens in and about *England*; whereby may be known, what *Moon* maketh a *Full Sea* in any of such places, and how many hours and minutes are to be added to the time of the Moons coming to the *South* for the time of *High-water*.

More-over, he sets down the Time of the *Suns* Rising and Setting throughout the whole year; and furnishes us *both* with a Table, shewing the Length of the longest Artificial Day in all places from the Equinoctial to the Poles of the World; and with other Tables readily discovering the exact time of the *New* and *Full Moon*, as likewise the first and second *Quadrants*, and consequently her true Age, from the year 1673. to 1700.

All which is concluded with an Advice touching the *Post*s and *Roads*, said to be done more exactly than hath hitherto been published; and with a Table, carefully comparing *Forrain Weights* and *Measures* with the *English*, by the industry of Sir *Jonas Moor* Knight.

IV. *A Brief Account of some Travels in Hungaria, Servia, Bulgaria, Macedonia, Thessaly, Austria, Styria, Carinthia, Carniola, Friuli, &c.* By Edward Brown M.D. of the Colledge of London, Fellow of the R. Society, and Phys. in Ordinary to his Majesty. London, in 4°.

THis Learned and Inquisitive Traveller gives so good an Account of the Voyages he made through those parts named in the Title, that thereby he excellently instructs others what great benefit may be made by Travelling, if performed with curiosity and Judgment.

In our Account of it we shall pass by the Observations made of the Polity, Oeconomy, Manners and Customs of the respective Inhabitants of those Countries, as not properly belonging to our task; and observe only what is Physiological, and may contribute to the enlargement of the History of Nature: In reference to which, we cannot but take notice, amongst many other, of these particulars following;

1. Of the shining Mountain of *Cliffura*, (one of the spurs of Mount *Hemus*,) and that of *Pyrlipe* in *Macedonia*, caused by the *Muscovia*-glasse they abound with.

2. Of Mount *Olympus* being inferior to some parts of the *Aipes* in height; Clouds also being seen above it.

3. Of the natural Productions of *Thessaly*, and in particular of the Plants growing there; among which is the *Ilex coccifera*, the Excretion whereof serves for dying and making the Confection of *Alchermes*.

4. Of a kind of Chalk at *Banca* in *Hungary*, which is of all colours, except green, and the colours so finely mixed, as Marble-paper doth not equal it.

5. Of the principal Mines of *Hungary*; as the *Silver*-mines at *Schemnitz*, 70 fathoms deep; abounding also with *Cinnaber*, *Crystals*, *Amethysts* and *Vitriol* naturally crystallized in the Earth: The *Gold*-mines at *Cremnitz*, about 9 or 10 English miles in length, of the depth of 170 fathoms; containing also *Vitriol* of divers colours, white, red, blue and green; and *Vitriolate* waters: Besides a neighbouring *Vitriol*-mine, about 80 fathoms deep: The *Copper*-mines at *Newsol* and *Herren-ground* containing very rich ore, and divers sorts of *Vitriol* and Springs of a *Vitriolat* water changing Iron into Copper: The *Salt*-mine at *Eperies* of great note, about 180 fathoms deep, yielding pieces of Salt of ten thousand pound weight.

In the description of all which Mines our Author delivers very particularly not only the situation, depth, damps, waters, quantities, goodness and richness of ore; but also the ways used by the Inhabitants of reducing their Ores into Metals, &c. All which would be too large to particularise in this place.

6. Of the many natural Hot-baths of Hungary, as at *Banca, Glasbitten, Eisenbach, Stubn, Boinitz*.

7. Of the considerable Baths of *Austria*, especially those at *Baden*, 4 German miles from *Vienna*; described, at large also from our Authors communications, in *Numb. 59.* of these Tracts.

8. Of a Strange Lake of *Zirchnitz* in *Carniola*, very curiously described.

9. Of the considerable Quicksilver-mines at *Idria*, confirming the Account given of the same in *Numb. 2.* of these Tracts.

10. Of a stony excrescence upon the Liver of wild Goats, highly commended in Germany for a signal remedy against malignant diseases and the Plague.

For the particular description of all which, and many more, we must refer the curious Reader to the Book it self.

ERRATA in Numb. 93.

Pag. 603. l. 1. r. about *Dyser.* p. 6015. l. 27. r. *Firre.* p. 6025. l. 7. del. or *Meeter.*

ERRATA in this Numb. 94.

Pag. 6032: l. 28. lege *Globulum suspensum è funiculo* (*juste longicudinis;*) these words being transposed in some Copies.

LONDON,

Printed for *John Martin*, Printer to the Royal Society. 1673.

PHILOSOPHICAL TRANSACTIONS.

June 23. 1673.

The CONTENTS.

Experiments of a present and safe way of staunching by a Liquor the Blood of Arteries as well as Veins; made both in London and Paris. Monsieur Slusius his easy way of demonstrating his Method of drawing Tangents to all sorts of Curves without any labour of Calculation. A Note of Dr. Wallis upon Mr. Listers Observation concerning the Veins in Plants. Mr. Listers Letter taking notice of Dr. Wallis's remarque, and withal containing some Anatomical Observations and Experiments touching the Unalterable Character of the Whiteness of the Chyle within the Milky vessels; together with divers particulars observ'd in the Guts. The Undertakings of Mr. Henry Bond concerning the Variation and Inclination of the Magnetique Needle. Some Observations upon a pleasant way of catching Carpes, by Mr. John Templer. An easy way of raising Fruit-trees to what numbers any desires, by Mr. Lewis. An Account of some Books: I. Christiani Hugonii HOROLOGIUM OSCILLATORIUM: II. Sr. Jonas More's MODERN FORTIFICATION: III. The Elements of that Mathematical Science, call'd ALGEBRA, by John Kersey.

Experiments made at London concerning the Liquor sent out of France, which is there famous for staunching of the blood of Arteries as well as Veins ; of which see Numb. 94.

May 30. 1673.

1. **A** Dog had the skin of his neck slit open and flaid by Mr. *Serjeant Wiseman*, so that the jugular vein lay bare. He then with his lancet open'd it, and immediately applied to it a button-pledget of lint dipp'd in that liquor. This being done, he took up the Muscles on the other side of the throat, and divided them till he came to the *Carotid Artery*. This he likewise open'd with his lancet, and applied a pledge after the manner aforesaid. These Pledgets, being kept on by pressure of the thumb about a quarter of an hour, were then taken off. The Vessels bled, but not freely : Whereupon the pledgets were changed for fresh ones, and kept on a quarter of an hour more ; being then first left loose, and afterwards taken off, the Vein and Artery were knit and solder'd together.

2. The same day a young Womans brest being by the same Chirurgion cut off, the *Arteries* were stopp'd by holding the like pledgets in the mouths of them whilst the dressings were fitted for the breast. The pledgets being then thrown off, the blood continued staunch, and the mouths of the *Arteries* remained close.

3. Whilst this later operation was performing, a Patient, whom *Serjeant Wiseman* had newly dressed with a Caustick Stone in the neck (upon some Scrophulous swellings,) was brought back to us in a coach, having bled all the way to the wetting of almost a whole sheet. The vessel lay so deep that it was hard to reach it. However, Mr. *Wiseman* dipp'd two pledgets in the liquor aforesaid, and thrust them into the two orifices whence the blood came. It was immediately stopp'd and the neck dress'd up without any considerable bandage.

Walter Needham.

The Woman, whose breast I cut off, came out of the country to me on Wednesday last, labouring under a Cancer ulcerated.

rated. She was weak and much indispos'd by reason of its frequent bleeding from a vessel out of our reach. About two hours after the writing above sign'd by Dr. *Walter Needham*, she was taken with a vomiting, and her breast bled. I was sent for, and found her swooning, and the Women about her in much confusion. I took off the dressings, and perceived one of the Arteries to bleed a little. I applied the French Essence, and stopt it; but douting the ill consequence, if it should bleed again in the night, I secured that Artery by the touch of a hot Iron.

Rich. Wiseman.

June 11. 1673.

There was made a fourth Experiment by the same Dr. *Needham* before the *R. Society*, though there was then but a very small quantity of that liquor at hand. A Dogs *Crural Artery* was cut quite cross with an Incision-knife; the blood gushing out copiously, a lint dipp'd in the said liquor was applied to the wound, and held upon it a litle while; when by reason of the great glut of blood, that could not be well wiped away for want of a spung, (which made the Experimenter conjecture, the application had not been exactly made,) the lint was changed for a fresh one dipp'd in the liquor, and kept on about half an hour, and being then left loose, the blood was soon stanch'd; whereupon the Dog being un-bound, licked this wound, and walked away without any ligature, and is still found alive and well.

June 18. 1673.

An other Tryal was made before the same *Society* by Monsieur *Denys* himself, Counsellor and Physitian in ordinary to the most Christian King, being come to *London* by his Majesties order. In the *Crural artery* of an other Dog was made an oblique wide cut, and the Liquor in the usual manner being applied to it, the blood was stanch'd in 7 minutes, and the dog being then let loose, but yet kept quiet for 23. minutes longer, he then arose and let fall the applied compress, and went away without any bandage.

To these Experiments we cannot but add those that were very lately made at *Whitehal* before his Majesty himself, who

did appoint the 20th. of June last to make Experiments of it; when two Calves, of the bigger sort by his Majesties command were brought into the Banqueting house; of one of which the Crural Artery being laid bare, it was cut open long-ways with a lancet and presently a lint dipped in the said Essence applied to the wound. The blood was stopp'd in about a quarter of an hour; but the animal being big and strong, and striving continually to get up, the artery broke out again, whereupon a fresh lint, dipped in this healing water, was laid on again. The blood was at length so stopp'd, that about the end of two hours the beast rose, walked about the house without loosing any blood more, though the wound had no bandage on it.

Of the other Calf the butcher cut off quite one of his legs as high as he could, and the blood rushing out impetuously, a compress of lint dipp'd in the Essence was presently applyed to the part. Here more care was taken than before, of keeping the Animal quiet; and about the end of a Quarter of an hour the blood was found perfectly staunch. Several of the Kings Physitians and Chirurgions did examine the wounds after the blood was stopp'd and found them clear without any escarr; and his Majesty himself declared publickly to be very well satisfied with it.

But these Experiments being made only upon Beasts, in this place, and some of our English Chirurgions, there present, doubting, whether it would do well upon Men, Tryals are to be made to satisfy that doubt; of which an account may be expected by the next.

Experiments made at Paris with the same Liquor; as they are described by Monsieur Denis in his 11th. Conference, printed in French at Paris April 30. 1673. of which the substance here follows in English.

THIS Author, having first mention'd the ways hitherto received and commonly used, in stopping the blood of prickt or cut Arteries; as that with a Thred and Needle, the touch of an hot Iron, the application of Vitriol or other *Scarotiques*,

rotiques, burning, like fire, the extremities of the Arteries and making an *Escar*, which you must stay for till it fall off, to know whether the blood be indeed staunched; having done this, *I say*, he takes notice; 1. That all those wayes are so little sure, that when a great Artery is to be dressed, the ablest Chirurgions constantly furnish themselves with all those helps, and have them all in readiness at the same time upon such occasions, that so, if one fail, they may have recourse to another. 2. That all those ways are so severe and un-natural, that the pain often raises a Feavor, and thereby casts the Patient into great danger of his life. 3. That, notwithstanding all those remedies, many Patients dy for want of means able to stop the blood; and that the openings of the Arteries ly sometimes so deep within the Flesh, that you cannot reach them, neither with the Fire, nor pledget, nor any adstringent powder: Whereas, *he saith*, this Essence hath none of all these Inconveniences; in regard it causes no pain at all, being applied to the wound; it easily penetrates through the Flesh, to find out and close the mouths of the Arteries, without any necessity of cutting away any thing, as you must do, if you will convey other remedies thither; and the effect of it is so quick, that in about a quarter of an hour, if it be well and exactly applied, the operation is performed; nor need you stay several dayes for the falling off of the *Escarre*, to be assured of the staunchness of the blood.

The Experiments by him recited are these;

1. The Crural Artery of a Dog was prick't with a lancet; presently a button-pledget, dip't in the Essence, was put upon the wound, and kept on by some lint laid over the said pledget, and held on by the thumb. In less than half a quarter of an hour the Artery was so closed, that the pledget being remov'd, not a drop of blood was seen to issue.

2. Two dayes after the other Crural Artery of the same Dog was laid open, and having cut it quite through with scissers, a compress of lint dip't in the liquor was immediately applied to it, and half a quarter of an hour after, the compress being remov'd, the wound was found very dry; only there run out a little blood, that was extravasated in the neighbouring parts, whereas the Artery it self yielded not a drop.

3. Of

3. Of an other Dog the Flanc was cut with a pen-knife, which did penetrate into the Liver. The same knife was run into the groin of another Dog, and a Vein, Nerve and Artery cut together to imitate the flashing of a Sword, and to see the effect of this sanative water in that case. All these wounds were speedily cured, without any ill accident to those Animals.

4. To see, what this Essence would perform in cases of whole Limbs quite cut off, which sometimes must be done to prevent Gangrenes; a Dog was taken and one of his Legs altogether cut off, and a compress of lint, melted with the Essence, laid upon the cut Veins and Arteries. At the end of a quarter of an hour the compress was taken off, and also the Bandage, that held it against the stump of the Leg cut; and the blood was found so stanch'd, as if no vessel had been open'd in that part.

5. These Experiments having so well succeeded upon Brutes, and been repeated over and over with the like success, no scruple was then made to try the Liquor upon Men. First, there were open'd Veins upon Arms, as is done in ordinary Phlebotomies, and a Lint dipp'd in the Liquor having been held on the wound half a quarter of an hour, the Veins were found so perfectly closed, as they are wont to be in the common way after 24. hours. An other being bled in the Temporal Artery, and the like application made, he went abroad, and took a turn in Town without any compress, or bandage, the Artery never opening again.

6. The same Essence hath also been very successfully used in Fluxes of blood, giving it at the Mouth in ptisane: And surprising effects of it have been seen in cases of Bleeding at the Nose; seeing that as soon as a pledget of lint, moisten'd with this liquor, was put into the nostrils, the blood was stop'd, after those had been tired out, who to no purpose had tryed all the other common remedies.

7. Some Chirurgions have with good success made use of this water: For having used it only twice upon several wounds, as a Head broken by a fall upon a pavement; a great cut in the Hand; a Leg wounded by the flinging of a Stone, &c. they

they have avowed this Essence to be able to close and heal wounds in 2 or 3 dayes, which they could scarce heal in 15. days with their best Unguents.

8. To shew further that extraordinary quality of this Essence, Mr. *Denis* observes, that it heals wounds without any visible cicatrice and without any suppuration; saying, that by the same propriety, it hath of staunching blood, it not only closeth the Orifices of Vessels open'd, but it likewise so constricts the Pores of the Fibres of the Flesh uncover'd, that it suffers no Air to enter, nor any humor to extravasate out of the wound: And by this defending a wound against all the alterations that may survene either from without or from within, it preserves from all suppuration, and keeps the flesh entire; and the wound closing without any loss or reproduction of substance, we need not wonder, *he saith*, that 'tis done in a short time, and without an apparent cicatrice.

Having dispatch't so far, he takes notice of some, that have made it their business out of envy to discry this Discovery; some saying the thing not to be so new as was pretended; others, that it would not succeed upon Men, though it did upon other Animals; others, that this secret was not unknown to them, there needing no more but to make a solution of Alume or Vitriol to stop the bleeding of Arteries.

To which he makes this return: 1. If any Authors mention such an Essence, it ought to be made out, that 'tis the same in kind with this; but he defies all that have most frequented Hospitals and Armies, to say, whether ever they have hitherto seen used a liquor, by which the blood of Arteries open'd hath been presently stopp'd, as well in the cutting off of limbs, as in ordinary wounds. 2. That Experience proves the efficacy of this liquor upon men as well as Brutes. 3. That some of these who have stopp'd the blood with Allum or Vitriol, have done it only in appearance, only for some moments; others have staunched it indeed by so drying and burning up the wound, that the Animals died upon it; others could not stop it neither in effect nor in appearance.

He adds, that for finding the real effect; he will answer for none but that of his composition, being assured, that when he

he shall discover all the Ingredients that compose it, all will agree, that no things could be pitch't upon more powerful for a quick stopping of blood, and withal less subject to cause inflammation either within or without.

Then he complains of some men, that knowing the Effects of this remedy, would rather let men suffer in their misery, than permit to ease them by the use of this liquor; taking notice of those, that lately would let a poor man dy of the bleeding at the Nose, rather than give way to apply this remedy, if they had not been over-ruled by others, who after the fruitless application of all sorts of remedies for 5 dayes together, stopp'd that Bleeding presently by putting 2 or 3 drops of this Essence into the Nose.

After this he advertises the publick, that his liquor is that, which hath been approv'd of by his *most Christian Majesty* at *Paris* and *St. Germain*, in the presence of some of the most intelligent Physicians and Chirurgions of that Kingdom; adding that his Essence is to be found in one only place at *Paris*, upon the Key of the *Augustins*, at Mr. *Quenet's* Bookseller, à l' *Enseigne de l' Esperance*.

He concludes, that since the making of the Tryals above recited, it hath been found, that this water not only stops in a short time the Bloud of Arteries cut, and heals wounds very quickly without suppuration; but also that it so reunites the extremities of Nerves and Arteries cut, that Animals shall not be lame after. And to assure himself of the manner how this was done, he saith, he hath examined the parts, of which the Nerves and Arteries had been cut, and then healed by this Essence; and that in the dissection made of such creatures, he with others had found them whole, and the extremities of those Vessels as perfectly reunited together, as if they had never been sever'd.

The same M. *Denis* affirms, to have received news from *Calis*, that an Officer of the Ship called *le Tonant*, having his shoulder broken by a Canon-bullet, was carried into an Hospital, where the Axillary artery together with his Arm being cut off, the bloud of it was stop't with nothing else but a lint dipp'd in this liquor; left fastn'd on to the artery till next morning.

He

He adds, that from *Maſtricht* alſo 'twas written, that with the ſame liquor the blood of a leg had been ſtopp'd, the half of which had been carryed away by a Canon-bullet.

Illuſtriſſimi *ſluſii* modus, quo demonſtrat Methodum ſuam ducendi Tangentes ad quaſlibet Curvas abſq; calculo, antehac traditam in horum Actorum N^o. 90.

— **D**E *Clar. Viri* Methodo nihil aliud dicere poſſum, niſi mihi videri meam eſſe, quâ nempe tot ante annos uſus ſum, & cujus ope flexus Curvarum contrarios ac Problematum limites oſtendi tum in *Miſcellaneis* meis, tum etiam in literis, ſi rectè memini, olim ad te datis. Quâ viâ in illam inciderit, & quomodo illam demonſtret vir doctiſſimus, ab ipſo intelligere poteris: Ego ſanè paucis, ut aliàs ad Te ſcripſi, & vulgò notis, Lemmatibus rem abſolvo; atque, ut candidè Tecum agam, ecce ipſa Lemmata;

1. Differentia duarum dignitatum ejuſdem gradûs applicata ad differentiam laterum, dat partes ſingulares gradûs inferioris ex binomio laterum; Ut $y^3 - x^3 = y^2 y + y x^2 + x^3$. Legitur hoc apud pleroſque & facilè oſtenditur.

2. Tot ſunt partes ſingulares ex binomio in gradu quolibet, quot unitates habet Exponens dignitatis immediatè ſuperioris; tres nimirum in Quadrato, quatuor in Cubo, &c. Et hoc vulgò notum.

3. Si quantitas eadem applicetur ad duas alias, quarum ratio data ſit, Quotientes erunt reciprocè in eadem ratione data. Quod quidem evidens eſt vel cuilibet Arithmeticæ candidato.

His Lemmatibus methodus mea demonſtratur: Nec multum temporis Tibi erit impendendum, ut demonſtrationem ex illis concinnes, cùm eo ordine à me diſpoſita ſint, qui ad illum quaſi manu ducit. Plura ſcribere me vetat temporis brevitās. Vale, meque ut ſoles ama. Dabam Leodii 3. Maii 1673

A Note of Dr. Wallis. sent in a Letter of Febr. 17. 1672. Upon Mr. Lister's Observation concerning the Veins in Plants, published in Numb. 90. of these Tracts.

— **A**S to the *Veins* of Plants, which Mr *Lister* observes not to be ramified, but rather bundles of them divaricated; they do in this represent the Nerves, which (as in Dr. *Willis de Cerebro* is observed) go together in that which seems the common trunk, like a bunch of Threds, which after separate and are variously divaricated; and these Nerys, being cut, shrink up (as the Veins of Plants,) as much or more than do the Veins or Arteries of Animals.

Dr. *Willis* observes also, that there are two sorts of Nerves; one arising from the *Cerebrum*; subservient to Voluntary motions, and of which we are conscious or take notice (and which properly belong to the Functions of the Sensitive Soul at least to the Functions of Sense;) the other, from the *Cerebrum*, subservient to the Involuntary motions, and of which we are not conscious or sensible, (and which belongs rather to the functions of the Vegetative Soul, (Nutrition, &c.) or at least the Insensible Loco-motive faculty:) And to these latter seem reducible those *Acts of Sense*, which Mr. *Lister* speaks of in Plants. See Dr. *Willis de Cerebro*. c. 19. pag. 241. Edit. in 4°. and c. 15. p. 187.

A Letter of Mr Lister dated May 21. 1673. in York, partly taking notice of the foregoing Intimations, partly communicating some Anatomical Observations and Experiments concerning the unalterable Character of the Whiteness of the Chyle within the Lacteous Veins; together with divers particulars observed in the Guts, especially several sorts of Worms found in them.

— **I** Come to your Letter, where the Analogy betwixt the Veins in Plants and the Nerves in Animals, hinted by Dr. *Wallis*, is a considerable notion, and I shall set myself a task e're long to examine them both again on purpose, and to give you my thoughts. In the mean time, I will entertain

certain you, if you please, with some Anatomical Observations and Experiments.

It hath been long in my thoughts and desires to have discovered the *Actual passage* of the Chyle into the *Lacteous Veins*; of which yet I never doubted, as I find some do at this day. The difficulty lyes in the certain and unalterable character of the Chyle's *Whiteness*, especially when received into those Veins. And yet it is as certain, that in a *Diabetes* the Urine retains all the qualities of the liquor drunk. Also in that famous instance of those that eat the fruit call'd the *Prickle-pear* (if I remember aright,) their Urine hath affrighted the Eater with the colour of blood, that is, with the not-alter'd color of the Juice of the Fruit. In these instances at least we cannot doubt but the Chyle, even in the *Lacteous Veins*, was qualified according to the food and drink.

To effect then something to this purpose, we have formerly, and that very often, repeated the Experiment of injecting highly tinged liquors into the Guts of a live Animal. It would be too tedious and impertinent, to write down the circumstances of many different tryals: We will only in short tell you the manner of performing it and the success.

We laced the skin of the *Abdomen* of a dog loosely for a hands breadth, and then opening it underneath the stitches, we took out either the *duodenum*, or any other part of the *tennia intestina*. The Gut, took out, we open'd with a very small orific, and having ready the tinged liquor luke-warm, we injected it upward and downward: Carefully stitching up the gut, and then drawing the Lace, we unloosed two of the Dogs feet, laying him on his side for what time we thought convenient. The tinged liquors we used, were good *Barbado's Indigo*, in fair water, and filtrated; also lumps of Indigo thrust down his throat; good broath (as they call it) of a blew fat; Indigo in Milk Saffron in Milk. Again, we tried in some Dogs fed before hand, and injected the liquors in the very height of the Chyle's distribution; into others yet fasting, and that for a longer or shorter time.

The Success was so constant, that we cannot say, we ever did find the least discolouring of the Chyle on the other side

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the Guts, that is, the within Lacteous Veins, but ever white and uniform. Whence we judge it not very feasible to tinge the Venal chyle in a well and sound animal. And He that would demonstrate the matter of fact to the Eye, must probably do it by giving him some such thing in the food, as shall cause a *Diabetes*, or some distemper equivalent to it.

Though we have observ'd many odd things in the several Exercises of this nature; yet we shall not trouble you at present with any other particulars, than what we have further observ'd in the *Guts*, to which we shall confine our paper. Of these we shall proceed to speak though possibly the things may be better known to you already:

As 1. of the *Glandulae miliares* of the small Guts, which may also in some Animals be well call'd *fragi-formes*, from the figure of the one half of a *Strawberry*, and which yet I take to be *Excretive* glanduls, because *Conglomerate*.

2. The Use of the *Intestinum cæcum*, subservient to that of the *Colon* and *Rectum*; manifest in such Animals, where Nature intends a certain and determinate figure to the Excrements.

3. Of some sorts of *Vermin*, we found in the Guts. And first of the *Lumbrici lati* or *Tape worms*. Of these, I say, we found in the guts of one Dog, perhaps more than an hundred in all. The *duodenum* was exceedingly stuffed out and extended with them. Which also well agrees with an other Observation I made in a Mouse, where I found the *duodenum* to be far bigger than the Stomach it self, by reason of the great numbers of these worms for kind, which were contained in it: For kind, I say; for these *Tape-worms* were of a quite different shape from those of the Dog, or any that I have ever yet seen. To proceed, we found them also in the Dog's *Jejunum* and *Ileon*; but not any one lower than the *Valvula coli*, nor any higher than the *duodenum* or within the *Pilorus*. Below the *duodenum* they lay at certain distances one from another, though sometimes by pairs or more of them twisted together. Near them was constantly to be observed an Excrement of their own, distinct, for colour (more grey) and consistence, from the Chyle, (the observation being made in

in a Dog plentifully fed for other purposes;) just as we find in worm-eaten tracks of wood, where the *Cossæ* leave behind them the wood which hath pass'd through their bodies: These worms lay mostly with the small ends upward, as feeding upon and expecting the Chyle in its descent. These *lumbrici lati* were none of them above one foot long, and most of them of an equal length and bigness. The one end was as broad as my little finger-nail, and pointed like a *lancet*; the other end, coming small gradually for the third part of the whole length of the animal, was *knott'd*, or ended in a small button like a pin-head. They were every-where and in all parts of them alike milk white, of a flat and thin substance like fine Tape, divided into infinite rings and incisures; each incisure having *sharp angles*, on both sides, *looking* to the broader end standing out beyond each other: From which also I take the small end to be the head; else the sharp corners of the *annuli* would necessarily hinder the Ascent of the Animal; whereas, if the contrary be true, they serve to keep it up. Each ring hath also on the one side only, and that alternately, one small protuberance, much like the middle feet of the body of some Caterpillars.

After I have thus described them to you, I desire you to view the Cut of *Tulpius* in the last years Edition of his *Medic. Observat. l. 2 c. 42*; where he retracts the first figure, given us in the Edition of that book in the year 1652. And yet I cannot say, that all in this last is true; for, to me, the *ridus* and eye in the there supposed head of the animal seem to be the meer faucies of the painter; not to say, that probably the smaller end is the head, which, indeed, is in this Cut wholly neglected. Comparing our Animals with that Cut of *Tulpius*, it was not very easy for me to observe, because of the great resemblance, the specifick difference of the *lumbrici lati* of Men and those of this Animal.

I was not so happy as to discover any motion in any part of them, in water or out of it, nor did they seem, if pricked or otherwise hurt, much (if at all) to contract themselves or shorten the *Annuli*, 'o that they then appear'd to me as things without motion or sense.

There

There is an other sort of *lumbrici latii* to be met with very frequently also in Dogs, called *Cucurbitini*, from the likeness each *annulus* or link hath to a cucumber seed. I have found of them about half a foot long, but more often broken into shorter pieces. The *former* by us described is undoubtedly a complete and entire Animal; but there is great reason of suspicion, that *this* is a *chain* of many Animals linked together. These Animals for Kind have been observed to have been voided by Men, and found enclosed in a Gut or Membrane of a prodigious length: And (which yet is more notable,) a person of great integrity and worth, M. T. I. affirmed to me, that he once assisted at the opening of a Dog, in which one of the Kidneys was observed to be quite wasted and become a perfect bladder, and in that bladder they found something like an Animal of a monstrous shape, which being dissected, was nothing else but a skin full of these *lumbrici cucurbitini*. It were to be desired, that such as have the opportunity of such new *Phænomena*, as of Snakes, Lizards, Beetles, Catterpillers, Toads and such like things, as we read of in Medicinal histories to have been voided or found in any part of the body, would carefully examine, whether they are not the like disguises of this sort of Worms, much assisted by the surprised fancies of the first Observers.

And because these sort of Wormes are sometimes said to be found out of the Guts, their most proper place, we shall conclude with a very recent observation of the last month in this City. A Chirurgeon brought me about 20 worms, which he had just then taken out of an ulcerated Ankle of a Girl of about eight years old. I had the curiosity to go myself and see it. I found the leg sound all but the Ankle, which was vastly swell'd, and the Girl otherwise hearty and well coloured. She had been in great misery for some months; had been sent up to *London*, where she was touched and dress'd for the Evil. Sometimes after her return, her pain continuing, a young Puppy was opened and applyed to the Sores. The Chirurgeon, who took off the puppy, found it, to his great admiration, full of worms, at least 60. in number, what those he found in the body of the Puppy, and what he drew out of the soar Ankle; into

into which, he said, they crawled down as worms do into the ground. The same puppy was again applyed, and it was then (at the second taking off of the puppy) that I made the visit, and saw only one worm got out into the puppy, but a very live and stirring one. Many were afterwards kill'd by injections. These worms I affirm, according to my best Knowledge, (and I had the opportunity of comparing them) were of the very Species of the *Lumbrici teretes*, which Children familiarly void from the Guts. They were betwixt three and four inches long; all, about the matter, of an equal bigness, as of one brood; something thicker than a Ducks quill; very sharp at both ends; stiff, and exactly round; without incisures, visible at least, and yet could move and twist themselves readily enough. All the difference was in the colour, these being much whiter than any I have seen from the Guts. *Vid. Barthol. in Hist. 60 Cent. 5.* where neer twenty worms, as long as my finger, were found in a Lady's arm, probably of this Species too.

I beg your pardon for my, &c.

The Undertakings of Mr. Henry Bond Senior, a famous Teacher of the art of Navigation in London, concerning the Variation of the Variation of the Magnetical compass and the Inclination of the Inclinary Needle; as the Result and Conclusion of 38. years Magnetical Study.

THE said Mr. Bond can shew the Cause of the Variation of the Variation of the Magnetical Needle or Compass by the Motion of two Magnetical Poles; how these Poles are found; and what their Distance is from the Poles of the Earth; what their Annual Motion is, and from whence it proceeds.

By Calculation he finds all the Variations that have been observed at or near London for above 90 years past, and so by consequence it may be found at London to the end of the World.

He hath calculated a Table to every five minutes of the Inclination of the Inclinary Needle; so that by the Needles
Incli-

Inclination, and that *Table*, and the *Latitude* of the place, he can find the *Longitude* of any place in world.

By that *Table* also he finds *Mr. Rob. Normans Inclination*, which he found *A 1576*; and can shew, what will be the *greatest* and *least* *Inclination* of the *Inclinary Needle* in any *Latitude* in the world.

He hath four *Examples* of finding the *Longitude* by the help of the *Inclinary Needle*; one at *Balora* in *East-India* in the year *1657*. Another at *Cape Charles*, on the coast of *Virginia* before that time. The third, at the *Cape of Good Hope*. The fourth, at the *Straights of Magellan*.

So far *He*: who, 'tis hoped, will shortly by the generosity of some *Noble Virtuoso* or other, recompensing his studies and pains, be induced to discover to others this his knowledg.

An Extract of a Letter written by Mr. John Templer June 16. 1673. containing some Observations upon a pleasant way of catching Carps.

— ON Thursday last, *Sir Justinian Isham* invited me to walk with him to his *Fish-ponds*, and to see a boy throw out *Carps* with his hands at any time in the heat of the day. I saw four very large ones, that the boy took. His way was this: He waded into the *Pond*, and then returning to the sides, he would grope them out in the *Sedg* or weeds, and, tickling them with his fingers under the belly, quickly remove his fingers to their gills, and throw them out upon the land. And this he did not in a narrow but large pond, of half an *Acre* of ground, or rather an *Acre*. In which practise I must note two or three things, that seem observable to me;

1. *Carps* (and I suppose all other fish that keep near the bottom) keep alwayes in a shoal, although happily there may be more than one company, answerable to the difference of their *Sexes*; as in *Deer* at some seasons.

2. When they move from one place to another, they raise the mud in the heat of the day; and you may easily observe, what

what road they travel, by the muddy tincture near the bottom of the water, and that so certainly as you cannot easily miss of covering the greatest part of them with a cast-net; as I have formerly been shown by Mr. *Ferdinando Pulton* of *Desborough*.

3. (What I would most observe;) The boy knows, when he is upon the Carps layer (if I may use that term,) by the warmth of the water; and when he finds that heat in the water, though he neither see nor feel any Carps (in the middle of the pond,) he immediately repairs to the sides to pursue his game. I am, &c.

An easy way of raising Fruit-trees to what numbers any desires; communicated to the Publisher, by Mr. Lewis of Totnam High-cross.

TAKE a piece of the root of any Apple-tree or Pear-tree, &c. about six inches long, and tongue-graft a graft of an apple or pear into the root. The way of Tongue-grafting is, to cut the root sloping about one inch, and the graft sloping in like manner one inch; cutting both very smooth. Then cleave the root and the graft likewise about one inch, and enter them into one another, that the sap of the graft may joyn to the sap of the root as much as you can. Lap the joynted place about with a little hemp or flax-hurds; set the root so grafted into the ground about ten or twelve inches deep, so as the joynt may be covered at least four inches under the earth, that it may not be bared at any time, but kept moist by the Earth.

The root you graft upon, must not be less than your graft; it is no inconvenience, if it is bigger; then you can joyn the sap of the graft and root only on one side. It is best that the root and the graft be of the same bigness; then they will joyn on both sides: But there is no need you should be critical.

It is not necessary, the Graft should be of one years growth: Your Graft may be any fair streight branch, as big as a mans-finger, five or six foot long, provided the root be proportionable.

The Roots of young trees are to be preferred before the roots of older trees, because they will be more apt to take in sap and nourish the branch grafted into them.

The best roots of all, are those that come of kernels, which may be drawn at one, two or three years old, according to their growth. One plant must yield several Roots according to its bigness.

The Informer assures us, that 29 years since he sowed a bed of apple-kernels in *March*, in which year he planted an Orchard of Apple-trees and Pear-trees that cost 12. *d.* the tree. The spring following he pluckt up 40 of those seedlings, grown to the thickness of a fair graft, he grafted them in this manner of tongue-grafting, and planted them again. They all grew, and four of them bore fruit to perfection that year; so that in a year and half from an apple-kernel he had ripe fruit. Four of those trees, bought at 12 *l.* the tree, died; for want of a better supply, four of these trees thus grafted were planted in the rooms of those which died. These four trees will now bear two quarters of apples upon a tree; and are bigger than most of those trees amongst which they stand, which cost 12. *d.* the tree, when these were Kernels. He doth conceive, that plumbs, cherries, apricotts, peaches, and all sorts of fruit-trees may be thus raised; but he hath not made an Experiment any further then upon apples and pears.

If any desire to be further satisfied of the executive part of this, and the success of it, they may repair to *Totnam High-Cross* four miles from *London* in the road to *Ware*, where they themselves may see this performed.

An Accompt of some Books.

II. *Christiani Hugemii Zulichemii HOROLOGIVM OSCILLATORIUM. Parisiis, 1673. in fol.*

THIS eminent Mathematician divideth this Treatise into Five parts, of which,
The *First* containeth his description of the Pendulum Watch.

The

The *Second* treats of the descent of Heavy bodies, and their Motion in a *Cycloid*, that is, in a Line, which a Nail, fastn'd in the circumference of a running wheel, by its continued circum-rotation designeth in the Air.

The *Third*, of the Evolation and Dimension of Curve Lines.

The *Fourth*, of the Center of Vibration.

The *Fifth*, of the construction of an other Watch, wherein the Pendulum moveth *Circularly*, together with some Theorems *de Vi Centrifuga*.

Why the Author hath joyned all these matters together in this Book, will appear from his own discourse premised in the beginning of the same. It seems then, that having, since the publication of his first Tract concerning the Watches by him invented, found many things relating to the perfection of that work, he thought good to gratify the publick with them; especially seeing that these Particulars are by him lookt upon as the main, and, as 'twere, the ground of this whole Mechanism; which before it was destitute of. For, a simple *Pendulum* being no Certain and Equal Measure of time, in regard that larger excursions are observ'd to be slower than the narrower, he hath by the aid of Geometry lighted upon a way of suspending the *Pendulum*, by finding out a certain Curve Line, that is appropriate to give it that desired Equality, which having applied to Watches, their Motion hath by this means been rendred so constant and certain, that by frequent Experiments they are now known to be exceedingly useful both in Astronomy and Navigation. This being the *Cycloid* above-mentioned, our Author maketh it his chief business in this Treatise to give a very accurate demonstration thereof. To which he thought it requisite to premise some new Demonstrations to establish and advance the Doctrine of *Galilæi* touching the Descent of Heavy bodies, the top-fruit of which he counts to be this very propriety of the *Cycloid*.

But then that this *Cycloid* might be adapted to the Use of *Pendulums*, he thought himself obliged to enter upon a new consideration of Curve Lines, *viz.* of those, which by their Evolution generate other Curves. Whence resulted the com-

parison of the length of Curve lines with Streight ones; which argument, by reason of its excellency and novelty, he acknowledges to have prosecuted further, than his present design required. Where occurs the way of finding a streight line equal to a *Paraboloid*, invented by that intelligent *English Gentleman William Neile*, since snatch't from us by an untimely death, to the exceeding great regret of those that knew his worth.

Besides, for the clearer explication of the nature of the Compounded *Pendulum*, the usefulness whereof he shews in the construction of these *Automata*, he thought fit to subjoyn thereunto the speculation of the *Centers of Agitation*; in which occur many considerable Theorems, appertaining to linear, plain and solid figures.

To all which he promises the Mechanical Structure of the Watch, and the Application of the *Pendulum* thereto; enriching that part with his Table of the *Æquation of Dayes*, as also with a Relation of the several successes of such Watches employed in considerable sea-voyages; of which *he saith* the best of all hath been, which was found in the Expedition of the late Duke of *Beaufort* into *Candia*, who having taken with him in his own ship two of those Watches, and appointed a good Astronomer to take care of them; The longitudes of the places, which they either touched at in that voyage, or which in passing by they could see, were by means of the said watches exactly measured, so as that the very same differences of longitudes were found by the accuratest Maps assigned to those places.

But since those Tryals, our Author affirms to have improved his watches by using a *Pendulum* of a Triangular figure, and by an other way of suspending them: of which he gives an ample description; to which we refer the Reader: concluding this account with taking notice of his *Universal and Perpetual Measure*, which he establisheth by exactly taking the measure of the distance from the point of suspension to the center of agitation of a simple *Pendulum* vibrating a second of Time; which being found to be such a length as being divided into three equal parts will make such a measure, as he calls an

Horary

Horary foot, which having such or such a proportion to all other Feet may be used to settle a constant and certain measure every where, and to recover it in all ages; Forasmuch as Time will be always and in all places the same, and consequently such a length being taken as exactly equals a second of Time, a just Universal Measure is obtained.

II. *MODERN FORTIFICATION, &c.* By Sir Jonas Moor Master Surveyer of his Majesties Ordnance. London 1673. in 8°.

THE Worthy and Intelligent Author of this Book comprehends in a small volume whatever hath been designed and practised by the Latest and most Experienced Ingenieurs of this Age, *Italian, French, Dutch and English*; and the manner of Defending and Besieging FORTS and other PLACES; together with the Use of a Joynt-Ruler or Sector for the speedy description of any Fortification. All which he doth by such easy Rules, as if he had calculated this his Treatise for the meanest Capacities.

He divides the Book into 8. Chapters.

The *first* contains certain Propositions necessary to be known before-hand, borrow'd from Geometry; as also his way of taking the Plat of any Town or Place, together with his great care in reconciling the differences of Measures of several Countries, found in the Tables of *Snellius, Dogen, Greaves, Nicciolus, &c*; and particularly in comparing the *English Foot* with the famous Measures of other Places; mentioning withal *Monton's Universal Foot*, or a *Pendulum* that will vibrate 132 times in a minute of Time.

The *Second* treats of the most Modern Fortifications of regular Figures; where the Author, discoursing of Count Pagan's way, wherein the *Flank* stands at right Angles with the Line of defence, takes notice, that this way hath been not only approved, but much facilitated by his Majesty of Great Britain, CHARLES II.

The *third* teaches the Uses of the Joynt-ruler, among which those are very considerable ones, that it contains not only a Table shewing, what weight of Powder is allowed for Proof of

of all Guns cast in *England*; but also the weights of the Shot in Iron for the several sizes of Guns, together with the weight of the Powder allow'd to each Sea-gunner for service. Where the Author inserts a very necessary and useful Advice to this purpose, *viz.* That if the Sea-Captains would seriously concern themselves in employing trusty persons to see the Cartridges justly filled with the appointed Allowance, and at their leisure to turn the Powder out of some Cartridges already fitted, and weigh it, to see that the Gunner wrong not their Guns, they would find their Bullets fly further, and do more execution. Adding this remarkable note, that the Officers of the Ordnance know that Powder proved Tower-proof is a fifth part stronger than any *Dutch* powder that hath been brought thither.

The *fourth* treats of Rampires, Parapets, Tenailus, Motes, Covert-ways, and their several Dimensions and Measures; together with the whole way of laying down the *Profile*; as also the Rules how to cast up the Solidity of a *Rampire* and its *Parapet*, together with the *Parapet* of the *Covert way* beyond the *Counter scarp*, and thereby to proportion the Wideness and Depth of the Mote, that sufficient Earth may be gotten out of the same. Where is annexed the way of building up a Fort, and also the Estimate to be made of the Charges that will be required to do the same. To which is added a description of the works usually made both within and without *Forts*; as also the manner of describing upon Paper, by way of Perspective, the aforesaid Works.

The *Fifth* contains the doctrine of *Irregular* Fortifications; by which it appears, that 'tis requisite, an Engineer should make first a Plot of the whole Ground to be fortified, with all the ways, passages, old walls (if there be any) Rivers, Pools, Enclosures and all other matter fit to be known in the draught; which done, he may then design what works he shall think most agreeing to the place.

The *Sixth* teaches the way how to defend a Fort; and in order to it, how a Governor ought to be qualified; and what strength and number of Men, Victuals, Ammunition, and Instruments of war are necessary for its defence.

The *seventh* treats of the way of *Besieging* places, by blocking up, breaking of Ground, opening of trenches, building of Batteries, bringing on Galleries, and Mining.

The *eighth* delivers in *English* a short Discourse written in *French* by Monsieur *de la Mont*, of Fortification offensive and defensive, printed at *Paris* 1671. To which is annexed the *Table* of *Angles* taken out of *Count Pagan*.

So much of this Tract; which, we hope, will in due time, be follow'd by that large and costly piece, the Author saith in the *Epistle Dedicatory* he is now preparing, of all the *Forms* of *Fortifications*, and *Modles* of all sorts of *Engins* of war, of what nature soever, in fair Prints, that have been made or invented to this day: A very desirable work, the hastening of which is very much wish't by the Curious.

III. *The Elements of that Mathematical Science call'd Algebra*, by John Kersey. London 1673. *an. in fol.*

IN N^o. 90. of these Tracts, an *Advertisement* was given of a Body of *Algebra* prepared for the Press by that eminent Algebraist Mr. John Kersey, consisting of four Books. We now give notice to the Reader, that the *Two* first of them are since actually printed and now exposed to sale. As for the Argument of them since a pretty large account was then rendred concerning them in the said Tract, we shall now only acquaint the Reader;

First, that the Author will be found to have so fully and plainly handled the matter, that an ordinary capacity without any other Teacher may attain this excellent knowledg, which extends itself through all the parts of the Mathematicks, being the very Art of Invention of innumerable Theorems and their Demonstrations both in Arithmetick and all parts of Geometry, whether Plain, Curvi-linear, solid or local.

Secondly, that whereas many do wonder, why some forraign Nations are so fertile, and the English so barren of good Mathematical Books in their Mother-tongue, the reason thereof, and of the loss of many mens laborious and excellent writings and inventions, is, that the Booksellers being discouraged by the

slowness of sale, are not willing to undertake the printing of them. Now that *Algebra* may not have the same fate, we have this to say from the Judgement of sober and knowing Mathematicians, that there is not the like Collection of *Algebra* extant in Latin or any other Language, that we know of; whence this Book hath met with the approbation and applause of the most Learn'd in that Science: And if it find a suitable acceptation, satisfactory to our Stationers, it will encourage them to hasten the *third* and *fourth* Part, of which the *third* is a *Diophantus in Species*'s with many other excellent Problems of the like nature; and the *fourth* consists partly of Geometrical Theorems and Problems (many whereof are practical in Mensuration,) partly, but principally, of the Analitical Calculation and Geometrical constructions of Problems arising thence, demonstrated afterwards out of the Elements, according to the custom of the Antients, concealing the Method of Invention, (as is asserted by many,) for the magnifying of their Inventions, as if there had been no such thing as *Algebra* known or used.

Besides, it will doubtless induce the Learned to communicate their Notions and Collections of much excellent knowledge that lyeth strangely scatter'd in print in the most abstruse parts of Geometry, as in the Conical Doctrine, Angular Sections, Solid and Curvilinear Geometry, and Local determinations; about which we shall not further trouble the Reader or ourselves, till we find the success of this, which is now extant.

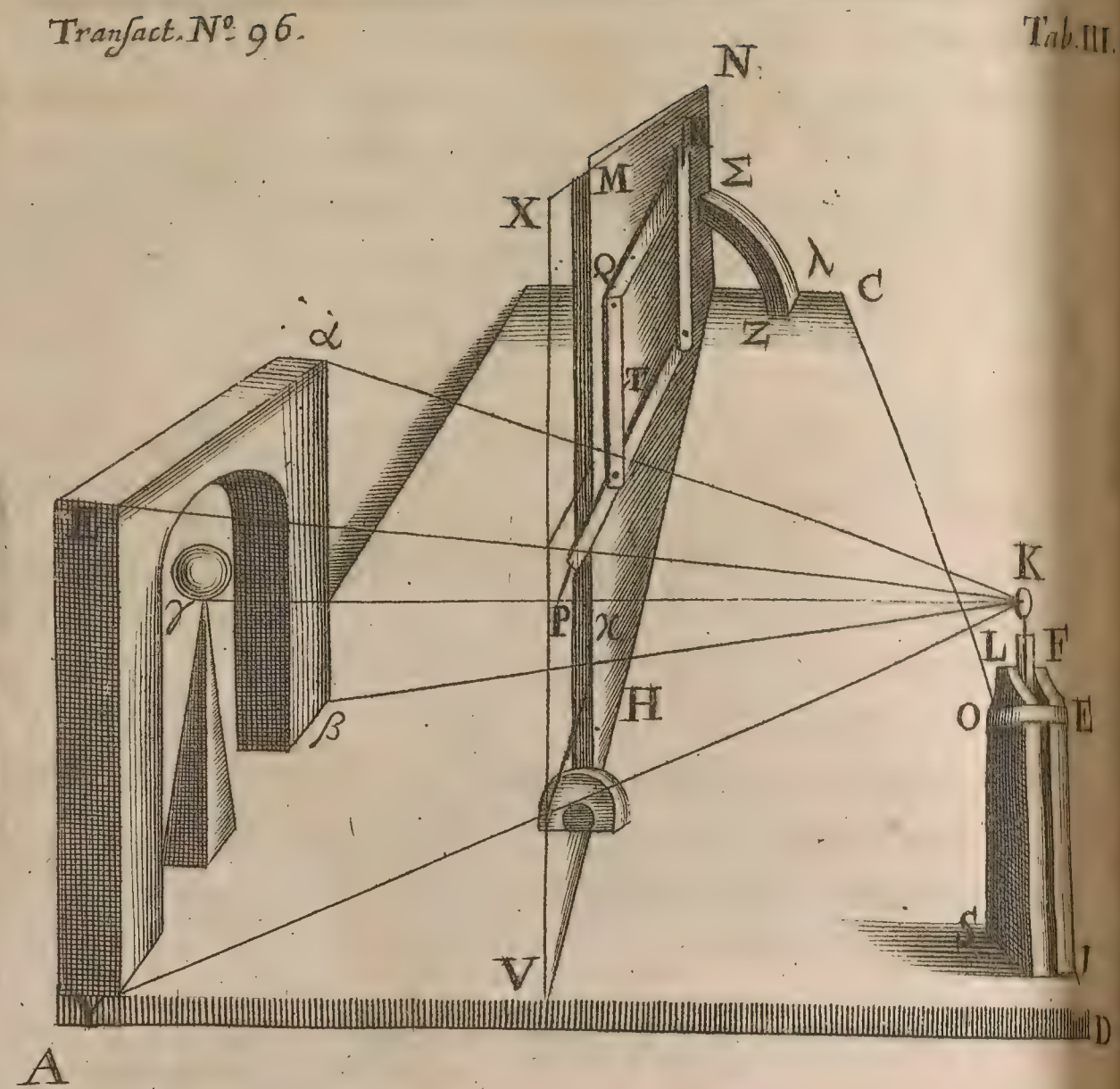
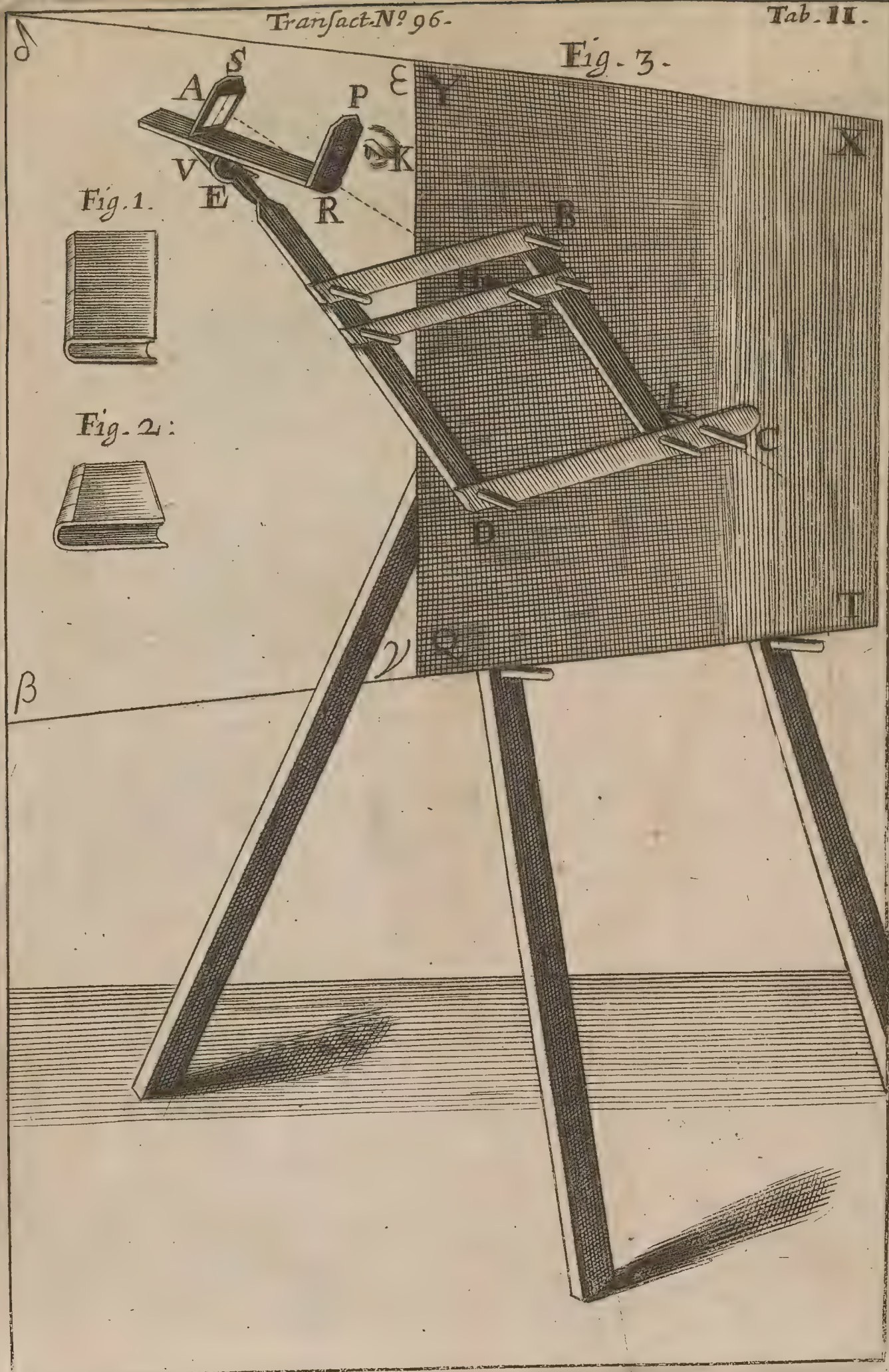
An addition to the above-related Experiments made with the Blood-staunching liquor.

Since the above-recited Experiments were printed, the Publisher received information, that with the same liquor there have been made two successful Operations upon two several Persons, a Woman and a Man, by applying it to the place, from whence a leg of each of them was cut off to prevent a gangrene. Of which the particulars not being yet given in, we must refer them to another opportunity, if they shall be found so considerable as to deserve to be described at large.

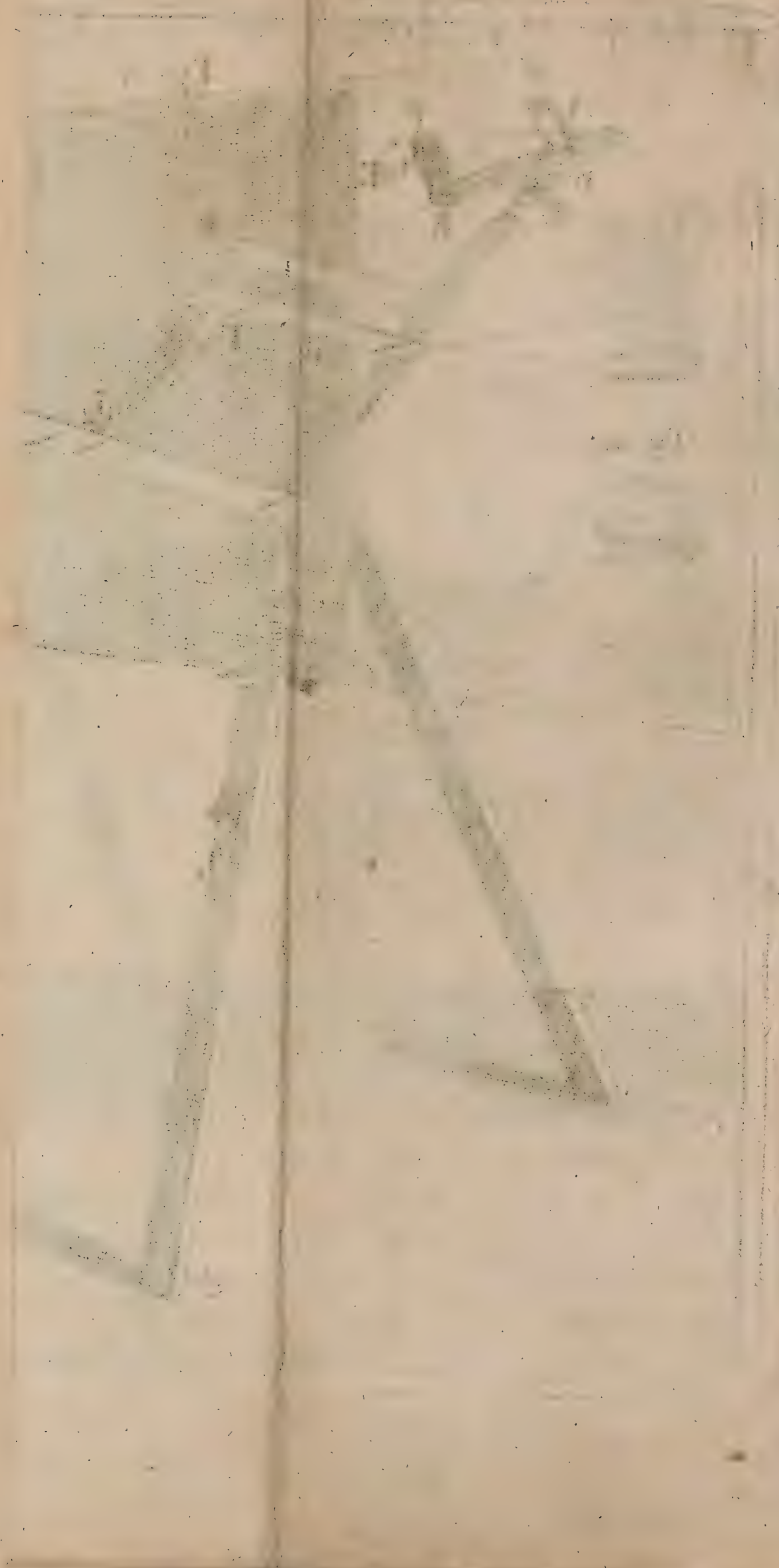
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London, Printed for John Martin, Printer to the R. Society. 1673.









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Fig. 1.

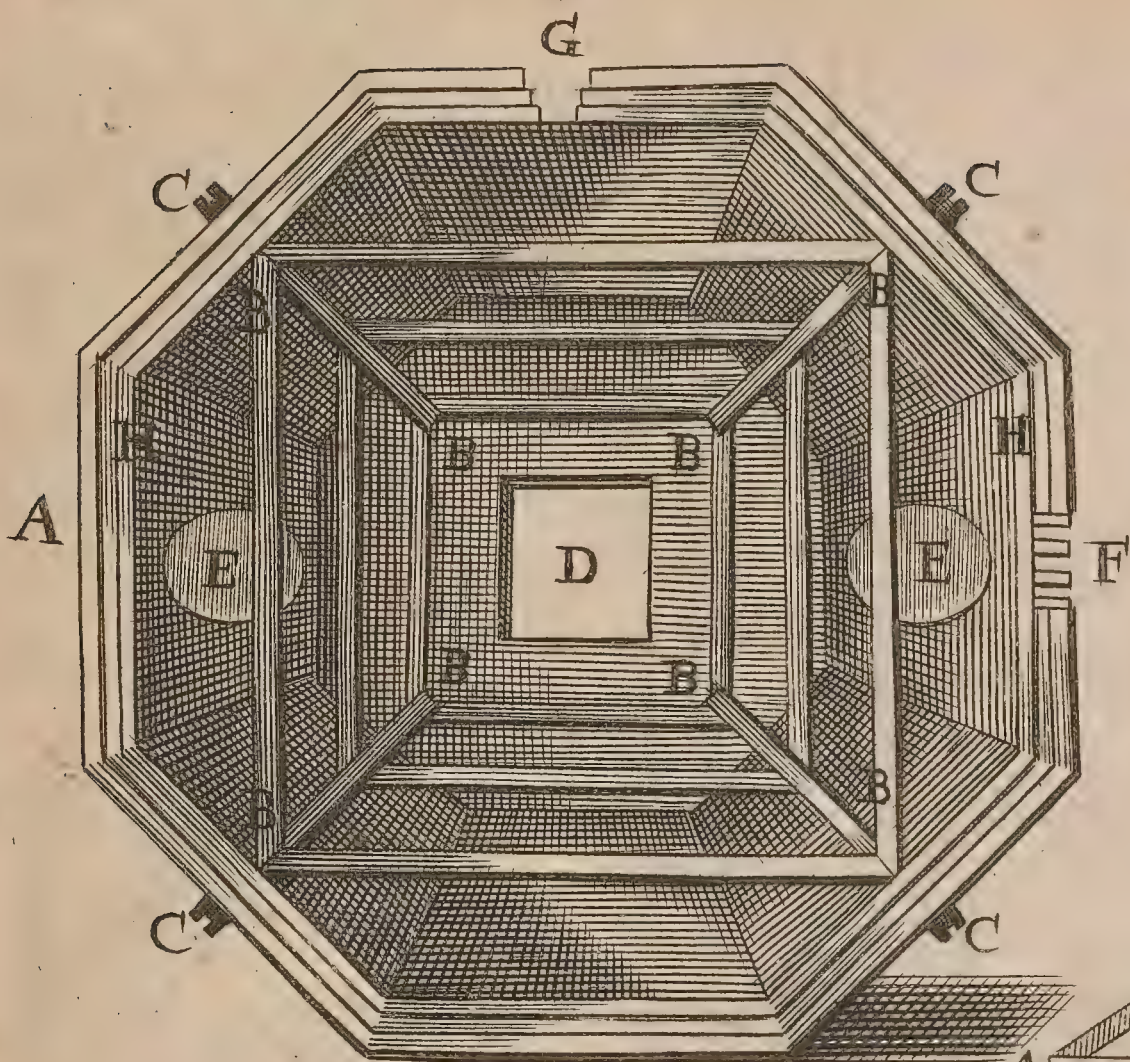


Fig. 2.

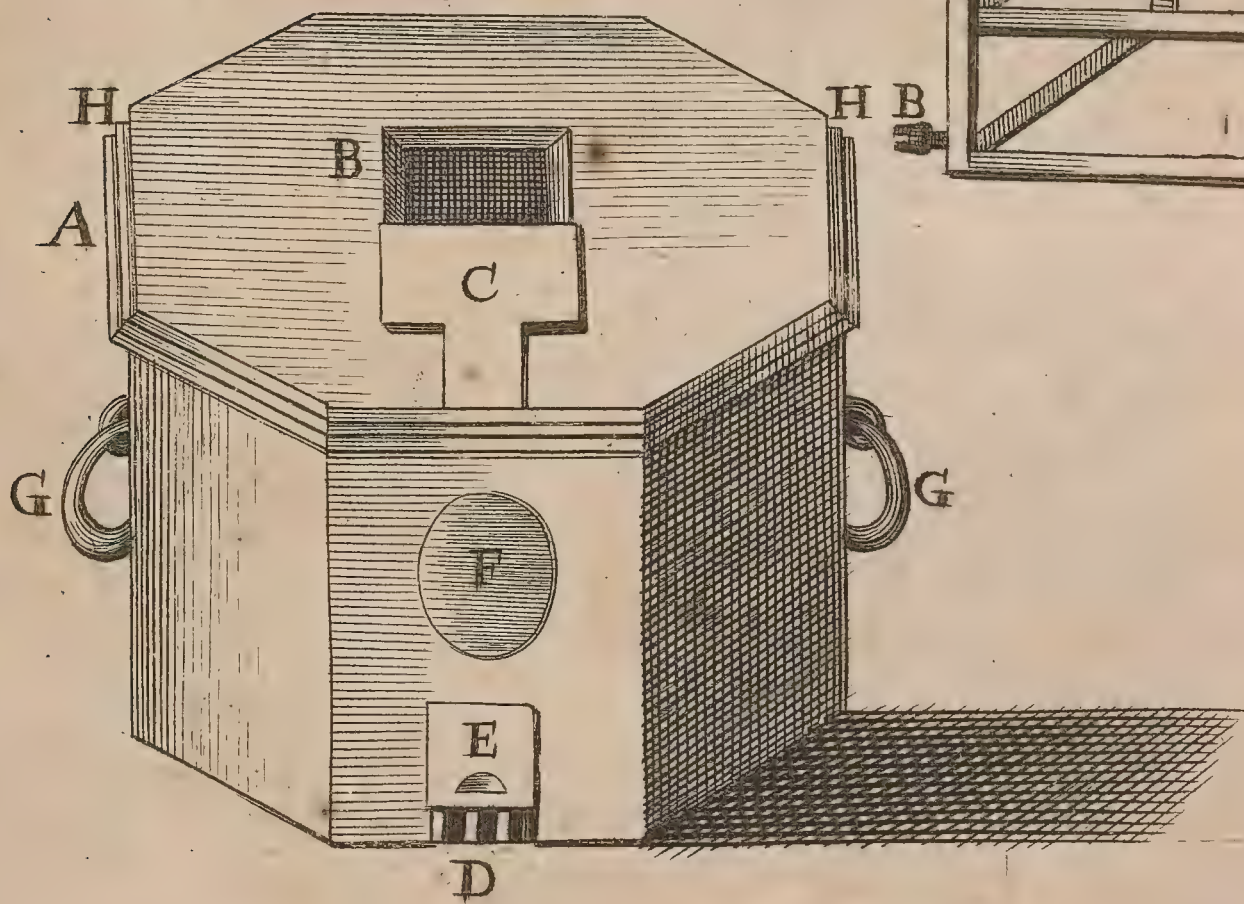
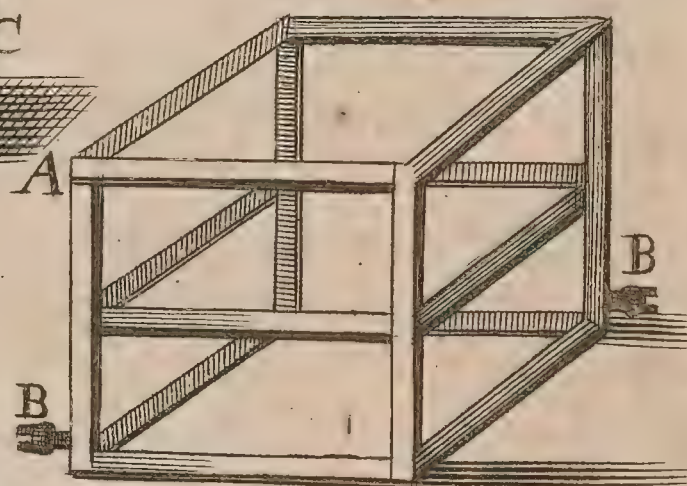


Fig. 3.



PHILOSOPHICAL TRANSACTIONS.

July 21. 1673.

The CONTENTS.

A Description and Representation of a Bee-house, useful to prevent the Swarming of Bees; used in Scotland with good success. An Account of the success of the Experiments, promised at the end of the next precedent Transactions. A New way of Orthographically delineating by parallel visual rays the postures and the actions of an Humane body, exactly observing the symmetry and proportion of the parts; by Mr. John Saint-Clare. An Extract of a Letter written by an Ingenious person from Paris, containing some new Considerations upon Mr. Newtons doctrine of Colours; as also upon the Effect of the different Refractions of the Rays in Telescopical Glasses. Mr. Newtons Answer to that Letter, further explaining his Theory of Light and Colors, and particularly his Doctrine of Whitene/s; together with his continued hopes of perfecting Telescopes by Reflexions rather than Refractions. A relation from Dantzick, of an uncommon Case in Physick; and another from the same place, about an odd effect of Thunder and Lightning upon Wheat and Rye in the Granaries of that City. A Letter of Mr. Flamsteed to Signor Cassini, containing some New Observations, made after a new and accurate way, of the farthest E'longations of the Medicean Stars from the Center of Jupiter; together with some other un-common ones concerning the Diameters of the Planets and their Distances from Fixed Stars, as also of the Parallax of Mars, &c. An Account of a Book: viz. Several Tracts written by the Honourable Robert Boyle, of the strange Subtilty, Efficacy, and Determinate nature of EFFLUVIUM'S; of New Experiments to make the parts of FIRE and FLAME stable and ponderable; together with some Additional Experiments about Arresting and Weighing of Igneous corpuscles; as also a Discovery of the Perviousness of Glassto Ponderable parts of Flame, &c.

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M A

A Description of a Bee-house, useful for preventing the Swarming of Bees, used in Scotland with good success; whereof one, sent by a worthy Gentleman, Sir William Thomson, may be seen in Gresham Colledg.

THough we find several Draughts of different Bee-hives, to the intention of preventing swarming, in Mr. Hartlib's *Common-wealth of Bees*; yet since none of those ways proved so effectual, as may justly exclude second thoughts and further experience, the Publisher thought it not amiss to present the curious with the following Form, and its description, wherein he thinks the Reader will meet with several improvements of those attempts that were made before.

Fig. I. Tab. I.

A The Bee-house lying on one side with the Frame placed in it.

BBBBBBBBB The Frame:

CCCC The Screw-pins that hold the Frame fast.

D The Square Hole at Top open.

E The Windows.

F The Door for the Bees to go in and out.

G The Place by which the knife enters to cut the Honey-Combs asunder upon occasion.

HH The inward crease at the bottom.

Fig. II. Tab. I.

A The Beehouse set upright.

B The Square-hole through which the Bees work downward.

C The Shutter that covers the hole upon occasion.

D The Door for the Bees.

E A sliding Shutter that covers the Door in winter.

F The Window.

GG The handles for lifting all.

HH The Crease for fastning one Bee-house over another.

Fig. III. Tab. I.

A The Frame for the Bees to fasten their work upon.

BB The Screw-nails.

The Bee-house is made of wainscoat, about 16 Inches in height and 23 in breadth between opposite sides. It hath 8 sides, each almost 9 Inches in breadth. It is close covered at
Top

Top with bords having a square hole in the middle, 5 Inches long, and about 4 Inches broad ; with a Shutter that slides to and fro in a groove about half an Inch longer than the hole. It hath 2 windows, opposite to one another, and may have more of any figure with panes of Glass and Shutters. The Door for the Bees is divided into 3 or 4 holes, about half an Inch wide, and as high ; with a shutter that slides in a Groove to cover them in winter. It hath 2 Iron-handles with joynts to be placed about the middle, if there be no windows on the sides where they are ; or above them, if there be. At Top it hath a Crease all round it about half an Inch in depth on the out side, and $1\frac{1}{2}$ Inch high ; and an other on the Inside at the bottom, which serves to fix them when set upon one another. It hath also a hole about 2 Inches in height and as much in breadth on one side at bottom, by which the knife is put in to cut the Bee's work, that passes through the Hole from one Bee-house into another as they work downwards into the empty house ; which hath a sliding Shutter to cover it. Within the Bee-house there is a square frame made of 4 Postes joyned at top, at bottom and in the middle with 4 sticks, for the Bees to fasten their work upon : which though they will serve, yet it may be securer to have two more added in every of their places crossing the frame either from the middle of the opposite side-sticks, or from Angles where the posts are placed.

This manner of Bee-house is useful for preventing the Swarming of Bees : For, when the Bee-house wants room for the young Bees, 'tis known that they swarm and fly away to find a house for themselves : which is prevented by placing an empty one made thus under the full one, having the door at Top open, that they may work downwards into it. And when both are full, the Bees will all be in the Lowest house ; and then, to get the honey and wax without destroying or troubling the Bees, with a thin long knife, broad at the end and sharp on both sides, the Bees work is to be cut as low as can be, and the uppermost Bee-house to be lifted off by the handles, and being reversed, the screws are to be taken out, and then the Frame with all the Bees-work upon it will easily slip out, and so the empty Bee-house may be forthwith set under the other, if need be, and the uppermost having the Square-

hole above covered with the Shutter, some other cover may be set over it to keep the Bees from the injuries of the weather. And if this separation be made in the Spring or Summer, the Bees will like their new house the better that it hath been used before.

What else is to be done, as to the right ordering and management of Bees, is to be learnt from the Authors that write of it, and from persons that are best experienced in it.

An Account of the Experiments promised at the end of the next precedent Transactions, concerning the wonderful Effects of the Blood-staunching liquor upon a Man and a Woman in St. Thomas's Hospital in South-wark London.

THE King having in his presence caused some considerable Experiments to be made with the new Blood-stopping liquor upon *Brutes*, and there remaining yet some persons here doubting, whether it would as well succeed upon *Men*; his Majesty gave order to his Chirurgions to go and see in the Hospitals, whether there were not some wounded persons whose blood had need to be stopp'd. Hereupon there were found two very fit Patients in the Hospital of *St. Thomas*. The first was a Woman labouring under an inveterate Scurvy and the Kings Evil, whose Leg was to be cut off, because of a malignant ulcer, not suffering her to sleep day or night. The other was a Seaman, whose Leg was also to be cut off, because of a wound accompanied with a fracture made by a cannon-bullet in the last Sea-fight.

The first Experiment then was made *July 3.* the King having sent some of his Physicians and Chirurgions to the said Hospital to be present at the operation, and faithfully to report to his Majesty what should pass there. The Leg therefore of the poor Woman being cut off, immediately the Arteries were dressed with some linnen pledgets dipt in the Astringent liquor with a compress upon it, and a bandage keeping all close against the arteries. The success was, that the blood was staunch without any other dressing; and instead of complaining, as those are wont to do who have a limb cut off, and the mouths of whose arteries are burnt with an hot Iron or a caustique to stop the blood, this Patient look'd very cheerful, and was free from pain, and slept two hours after, and also the night following

lowing ; and from that time hath found herself still better and better, without any return of bleeding , or any ill accident.

The 4th. of *July* the leg of the Seaman was cut off, and after the part was dressed as above with linnen dipp'd in the Essence, the blood was stoop'd in less than half a quarter of an hour. There was made a bandage, that pressed the linnen against the cut arteries ; and without any other thing the Patient found himself so eas'd of the pains he felt before, that he slept two or three hours after, and all the night following.

Next morning the dressings of the Woman as well as the Man were taken off in the presence of the same persons, and all the Physicians and Chirurgions there present did acknowledge, that no wounds could look more fair and ruddy ; there appearing no escarr at all, nor any more blood than if there had never been any veins or arteries open'd in that part.

These two Patients have found themselves very well ever since the operation ; and forasmuch as no ill accident hath befallen them since, they have served to convince the most incredulous of the goodness of this remedy.

The *King* easily concluding from these and the former Experiments, how useful this medicine would be in his Armies and Fleets, and understanding, that those who before opposed it, did now highly praise it, gave order, that Monsieur *Denis* should be desired to communicate the secret of it ; which being done, his Majesty commanded a quantity of it to be made in his own Laboratory, of which tryals were made upon three Calves in *Whitehall* the 12th of *July* ; a leg of each of them having been cut off, as high as was possible, and the blood of them stopp'd with this new liquor to the admiration of all the Spectators. For this Water having been prepar'd with more exactness than ever, the effect of it was so quick and effectual, that the blood was stopp'd in four minutes of time, the Calves by their motion making the pledgets to fall off, that had been put on the parts cut, and not a drop of blood appearing.

The *King* hereupon caused the quantities that had been thus prepared, which were very considerable, to be immediately dispatch't away to his Majesty's Fleet ; and 'tis not doubted, but that upon occasion all that shall happen to be wounded will receive great relief and benefit thereby.

PARALLELOGRAMMUM PROSOPOGRAPHICUM

SIVE

Modus novus delineandi per radios parallelos ad *Æqualitatem Orthographicam*, gestus, situs, habitusque quoscunque humani corporis, servata Symmetria, & proportionem partium.

Autore *IO ANNE* de Sancto-Claro Scoto-Lothiano.

Ut varias usus meditando extunderet artes.

Virg. Georg. I.

NOVUM modum delineandi per radios parallelos descripturus, de Clarissimi Scheineri arte delineandi, per eorum radiosum, quàm brevissimè potero paucis absolvam. Conficiendum mihi curavi Parallelogrammum lineare, cujus usu non contemnendum progressum in pictura feci, præsertim in Prosopographice, quæ ab hoc mirabili instrumento (ut ait Inventor) in supremo quasi eruditionis vertice collocatur, cujus ope nuper vultus hominum naturales secundum omnia faciei lineamenta etiam ad capillum Capitis in dato situ expressi, corporis humani gestus ad vivum dicto citius, idque non solum arte infallibili, scientifica, sed etiam modo cito, securo, subtili, absque fatigatione mentis, imitatus sum.

Expertus sum tamen (licet hoc non est quod sequiis de huius instrumen-

si præstantiâ ab Artifice statuatur) nequaquam inter partes Ectypi in plano, eam esse symmetriam, quæ inter partes Prototypi dissiti.

Cum enim delinearem nuper circino graphico Effigiem viri stantis, Vultusque erectos ad sudum cœlum tollentis, cujus manus dextera propinquior cathedra innixa est, altera remotior demissa; animadverti, Prototypon longe diversam formam nactam esse in plano, quàm in se habebat. Partes enim Autographi æquales, transcriptæ sunt in planum prorsus inæquales. Nulla quidem fuit discrepantia sensibilis inter apparentem magnitudinem manus dextera Prototypi, licet oculo propinquioris, & sinistra remotioris; Ectypi tamen in plano delineati manus dextera, sinistra major fuit, quia Sectio communis plani, & radiosi conii ad manum dexteram tendentis, major fuit sectione communi plani, & pyramidis optica ad manum sinistram protensa.

Statui præterea magnum librum Fig. I. Tab. II. super mensam, ad angulos axi optico obliquos, cujus in eo situ apparens magnitudo haud magno-pere differebat ab ejusdem apparente magnitudine in situ perpendiculari. Interposito autem plano delineatorio in quod projectus est liber, hanc formam, Fig. II. Tab. II. expressam, acquisivit priori prorsus dissimilem, cujus partes prout ab oculo (omnium radiorum, qui ab objectis protenduntur, principio & origine communi) remotiores, in plano paulatim diminutæ sunt, ut patet in libro, Fig. II. Tab. II, ob rationem supra memoratam. Ex quo luculenter cernere est differentiam, inter rei Apparentiam, ejusque Projectionem. Nam manente oculo (ut ait Aquilonius) ac rei situ, quantumvis planum in omnem partem mutetur, eodem tamen semper modo res apparet. At secundum plani situm alia & alia erit rei Projectio. Apparentia ex duorum duntaxat habitudine pendet, rei nempe objectæ, & intuentis oculi. Projectio verò insuper (quæ est rei solida in planum transcriptio), planum deposcit, in quod profusi radii variè incident. Obversetur enim Circulus aspectui directè; apparebit ut Circulus, si vero interponatur planum obliquum, neutiquam in Circulum projicietur, sed genuinam suam similitudinem exuet, formâ vel Ellipseos, Hyperbolæ, vel Parabolæ, pro varia sectione Pyramidis optica, cujus vertex oculus, basis autem res visa.

Est quidem inter res projectas à Parallelogrammo, earumque projecturas, Optica similitudo & æqualitas. Quia, cum projectura istæ sint optice similes & æquales uni similium & æqualium, nim. Speciei intersectioni, quæ objectum quo, & pictura objecti rationalis, & aerea dicitur, erunt etiam optice similes & æquales alteri quoque similium & æqualium, nim. objecto quod, seu rei projectæ.

Sed, ut ad propositum revertar, Experientiâ didici, quod jampridem rebar futurum. Memini enim, cum effigiem cujusdam in horto sedentis, cujus imago per lentem convexam in chartam transmissa fuit, ducerem, crura & pedes multum ultra reliqui corporis proportionem, utpote propriores, crescere. Neque est quod hoc novum aut insolitum videatur; sicut enim se habet Pantographices planum ad imaginem corporis propinqui, quæ ab ipso intercipitur; sic & charta lenti convexæ prætentæ ad imaginem, quæ ab ipsa excipitur, quæque à cor-

prore non admodum diffito per fenestram transmittitur. Planum autem Pantographices dico superficiem illam imaginariam in aere, quam Index Stereographicus percurrit, quaeque producta cum tabula superficie, in qua sit delineatio, coincidit.

Sed & apertius hoc fiet in umbrâ humani corporis; quò propiores enim aut noctu candela, manus aut pedes aut cetera membra eò majorem in pariete em oppositum umbram effundunt; quod cuivis obvium est. Extensis enim brachiis, quæ manus parieti proxima est minorem, quæ remotior est & candela propior, majorem umbram reddit; non secus ac quæ manus oculo delineantis propior est, ampliori imagine, quæ verò remotior, minori ducitur. Sicut enim se habet Parallelogrammi planum ad imaginem corporis describendi, sic & paries ad umbram, $\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha\alpha$.

Huius autem malo, quod ab ingeniosissimo alioquin Pantographices Inventore nequaquam notatum est, ut remedium aliquod reperirem, multa animo volvebam. Subibat interdum, nam qua ratione ad distantiam partium Prototypi, antrosum & retrorsum Parallelogrammum movendo, debite proportionales in effigie retineri possent. Sed dum nec in hoc exitum ullum mens reperiret, de imagine, quæ à plano Parallelogrammi intercepta, effigiem Prototypo Orthographice equalem redderet, cogitare cœpi. Hoc invento, cætera omnia prona & proclivia fore. In mentem igitur venit Problematis illius, quod olim apud Keplerum in Dioptricis legere memini: Lumen, scilicet. Candela noctu quàm longissimè ejaculari, Quod sæpiissimè me, & fratres, aliosque qui nobiscum literis operam dabant, crebris experimentis patrem meum docuisse recorder. Hibernis enim noctibus per tenebras densissimas trajecto ad longissimam distantiam lumine, quæ minutissimis typis impressa fuere, sacra Biblia non minùs facile, quam in meridiana luce legere erat. Cum enim, ut doctissimus ille Keplerus docet, eadem sit refractione radiorum, sive illi naturâ suâ ingrediuntur, sive egrediuntur, cum flamma lampadis aut candela in puncto, ubi radii solares concurrere solent, pone lentem collocatur, lumen transmissum radiis si non Parallelis, quasi tamen Parallelis, ad longissimam distantiam transfunditur; fitque ut quâ ratione interdum lumen solis superficiem lentis aversam ingreditur, noctu lumen candela aut lacerne ab eadem digrediatur. Sicque si (quod docent, nec sine ratione nonnulli) lumen sit corporis lucidi species visibilis, imago Parallela undique tenebris constricta habetur. Nec est quod cuiquam displiceat, quod voce hac in sensu absoluto utar, cum stricte loquendo in Categoria Relatorum sit. Omne enim parallelum cum alicui parallelum sit, & velatum est, cum Relata sint quæ id quod sunt aliorum esse dicuntur.

Sed cum Astronomi dicant Spheram Parallelam, cur non & mihi imaginem Parallelam, dicere liceat?

Sed quandoquidem mentio umbræ parallelæ incidit, ecce tibi aliud imaginis parallelæ exemplum in umbris, quæ oriente vel occidente Sole in parietibus radiis solaribus ad angulos rectos oppositis conspiciuntur, quæque licet tenebræ, multum tamen lucis in presenti negotio afferunt, cum Geometricè corporibus, unde fluunt, æquales sint. Dent veniam optici, qui facile

cile demonstrabunt, nec radios solares qui umbras illas parallelas claudunt, in rigore mathematico parallelas esse; cum non ad demonstrationem, sed ad illustrationem hoc exemplum utar.

Hisce praemissis, fingamus ab omnibus Prototypi punctis radios parallelas praeferendi, & ad angulos quàm fieri potest rectissimos in planum Pantographices incidere; quâ ratione fiat, ut Index Stereographicus omnia illa puncta saltem praecipua percurrat, nunc inquirendum restat.

Postulat Scheinerus inter delineandum, oculum prorsus fixum.

Sed, (si hac nova methodo delineandi utaris,) sit oculus in Profopographia liber & solutus, neque ulli certo puncto affixus, Proque Indice Stereographico sit Tigillum, seu regula oblonga, plano Parallelogrammi ad angulos rectos aptata. Tigillo deinde huic infigantur duae dioptrae, per quas oculus quasi collimare in omnia corporis describendi puncta, saltem praecipua, eâ ratione possit, ut radius visualis, per dioptras admissus, plano instrumenti semper sit perpendicularis, excipiatque Pantographices planum imaginem aeream ad angulos rectos. Et dum oculi acies unicuique objecti depingendi puncto successivè applicatur, stylus, debito praesente apparatu, in charta subiectâ, figuram objecti, secundum naturalem ipsius symmetriam, datâ proportionem, exactè describet.

In hoc casu dico, dummodo tantum à centro instrumenti distet stylus scriptorius, quantum ab eodem, radius ab objecto ad oculum per dioptras protensus, imaginem in Charta ductam Orthographicè Prototypo aequalem fore. Quod fuit quaesitum. Idque sic colligitur.

Quae sunt Orthographicè aequalia uni tertio, inter se sunt aequalia.

Sed Effigies descripta, & Prototypum, sunt Orthographicè aequalia uni tertio, nim. interceptioni imaginis parallela, quam excipit Parallelogrammi planum ad angulos rectos. E. & inter se sunt aequalia. Major est certa, utpote principium Geometricum. Minor ex hypothesis patet. Si quis autem Effigiem servatis proportionibus & symmetria diminui cupiat, hoc facillime assequetur, stylum Scriptorium inter indicem centrumque instrumenti collocando.

Sed objicient forsitan quidam, in objectis longe distitis dioptrarum nullum fore usum. Quid vero illud nostrâ interest, cum ad tollendas tantum in Profopographia difficultates, quibus hactenus Scheineri Parallelogrammum laboravit hac nostra Methodus comparata sit? Est enim, ubi commodius fixo, est, ubi commodius soluto oculo delineatio transigatur. Quousque autem soluto, & quando fixo oculo delineandum sit, altioris est disquisitionis. Occupator sum impraesentiarum, quàm ut huic indagationi vacem. Hac, brevitati studens, modò sufficere arbitror. Reliqua ingenioso tyroni data opera reservo.

Brevis & dilucida Parallelogrammi Profopographici descriptio, quo delineantur modo novo, per radios Parallelos ad æqualitatem Orthographicam, gestus, situs, habitusque quicunque humani corporis, servatâ Symmetriâ & proportionem Partium.

IN Schemate Fig. 3. Tab. II. Parallelogrammum Profopographicum est ABCD, stylus centralis HF, calamus designator LC, Index KA, sive regula oblonga, plano Parallelogrammi, ope clavi striati ex ære, secundum specimen E, ad angulos rectos aptata. Huic regula insiguntur duæ Dioptræ PR, SV; in medio PR pertusum est foramen O, in medio SV erigitur filum perpendiculare regulæ RA, in cuius medio est globulus quidam parvus, per quem, & foramen O, radius ad oculum (quem inter delineandum non oportet esse fixum, sed liberum & solutum) ab objecto protenditur.

1. Animadvertendum, radium per foramen O & globulum protensum, semper fore perpendicularem plano Parallelogrammi, sive ejus Diametro, quæ est recta linea extensa per stylum designatorium LC, & centrum fixum HF, & dictum globulum parvum, in qua linea semper versatur iste globulus, qualiscunque sit Parallelogrammi motus.

2. Not. Planum delineatorium sensibile, super quod volutatur apex L, styli pictorii LC, ad amussim describentis imaginem ad motum Indicis KA, & in quod infixus est stylus centralis HF, esse QYXT; planum verò merè rationale, sive mathematicum, priori continuum, esse $\varepsilon \delta \beta \gamma$.

3. Not. Omnes radios ab objecto per globulum & foramen O protensos (ad oculum, in tot mediis diaphani punctis, duce Indice KA. collocatum, quot sunt puncta in superficie Visibili objecti describendi, quæ sunt infinita,) semper fore sibi invicem Parallelos.

Quod sic probatur;

Quæ eidem rectæ lineæ sunt Parallele, sed non in eodem cum illa plano, hæc quoque inter se sunt Parallele; per Prop. 10. lib. 11. Euclidis.

Sed omnes radii ab objecto per Dioptras ad oculum protensi, eidem rectæ lineæ, viz. radio ab objecto per globulum & foramen O protenso, sunt Paralleli.

Ergo sibi invicem sunt Paralleli.

Prob. Minor. Si duæ rectæ lineæ eidem plano ad rectos sint angulos, Parallele erunt illæ rectæ lineæ, per Prop. 6. lib. 11. Eucl.

Sed Primarius radius ab objecto per Dioptras ad oculum protensus, & omnes reliqui radii secundarii, plano merè rationali, & mathematico, viz. $\varepsilon \delta \beta \gamma$, ad rectos sunt angulos; ex hypothesis.

Ergo omnes radii ab objecto per dioptras ad oculum protensi eidem rectæ lineæ, viz. radio ab objecto per globulum & foramen O protenso, sunt paralleli. quod erat probandum.

Now, to the end that the Reader may the more readily see the difference between this Instrument, and that of the Learned Scheiner, our Author thought fit, here to subjoyn a short description of that of Scheiner's, which performs the work by Conical, as the Author's doth by Parallel, species.

Descriptio parallelogrammi Stereographici à Clarissimo Mathematico Christophoro Scheinero excogitati, quo per conum radiosum, omnia quæcunque sub aspectum cadunt (ut pluribus apud authorem legere est) arte infallibili, dicto citius, in planum projici possunt, eodem situ, ordine, figurâ, magnitudine apparente quo oculus illa hausit.)

IN figurâ Tab. III. super mensam $ABCD$ benè planatam, horizontique parallelam, erige ad perpendicularum duas trabes LS , FI , conjunctas ligno transverso OE ab anteriore, & alio simili à posteriore parte, quibus imponatur lignum oblongum LF , ita ut ad arbitrium erigi ac deprimi possit, in cujus vertice infigatur dioptra K , ad specierum visibiliarum receptionem colligendam.

Postea ad distantiam HO tantam, quantam manus Artificis, ex K extenta, versus parallelogrammum regendum postulat, excita ad perpendicularum super tabulam DH asserem planum $HMNZ$, qui & parallelogrammum pendulum $PQRT$ sustentet, & picturam depingendam recipiat.

Ad punctum foraminis K corradiant singula puncta objecti oppositi $YE\alpha\beta$, lineis YK , βK , EK , αK , & aliis infinitis, quæ intelligi, non exprimi, solent. Per has ergo lineas, species visibiles objectum in foramen, & trans foramen in oculum defert, qui si in objectum fertur, & singulos ejus radios Indicis apice P abscindit, calamo T , imaginem depinget in superficie tabule $HMNZ$, similem illi imagini, quam planum $VXMH$, speciem visibilem secans, in aere comprehendit.

Asser delineatorius $HMNZ$ mobilis est factus in extremitatibus beneficio cardinis H , & arcus quadrantalis $\Sigma\lambda$, ut possit attolli & deprimi, inclinari & erigi, secundum arbitrium Artificis, & rei exigentiam.

An Extract of a Letter lately written by an ingenious person from Paris, containing some Considerations upon Mr. Newtons doctrine of Colors, as also upon the effects of the different Refractions of the Rays in Tele/copical Glasses.

I Have seen, how Mr. Newton endeavours to maintain his new Theory concerning Colours. He thinks, that the most important Objection, which is made against him by way of *Quære*, is that, Whether there be more than two sorts of Colours. For my part, I believe, that an *Hypothesis*, that should explain mechanically and by the nature of motion the Colors *Yellow* and *Blew*, would be sufficient for all the rest, in regard that those others, being only more deeply charged (as appears by the Prisms of Mr. *Hook*) do produce the dark or deep-Red and Blew; and that of these four all the other colors may be compounded. Neither do I see, why Mr. Newton doth not content himself with the two Colors, Yellow and Blew; for it will be much more easy to find an *Hypothesis* by Motion, that may explicate these two differences, than for so many diversities as there are of others Colors. And till he hath found this *Hypothesis*, he hath not taught us, what it is wherein consists the nature and difference of Colours, but only this accident (which certainly is very considerable,) of their *different Refrangibility*.

As for the composition of *White* made by all the Colors together, it may possibly be, that *Yellow* and *Blew* might also be sufficient for that: Which is worth while to try; and it may be done by the Experiment, which Mr. Newton proposeth, by receiving against a wall of a darkn'd room the Colours of the Prism, and to cast their reflected light upon white paper. Here you must hinder the Colors of the extremities, *viz.* the Red and Purple, from striking against the wall, and leave only the intermediate Colors, yellow, green and blew, to see, whether the light of these alone would not make the paper appear white, as well as when they all give light. I even doubt, whether the lightest place of the yellow color may not all alone produce that effect, and I mean to try it at the first convenience; for this thought never came into my mind but just now

now. Mean time you may see, that if these Experiments do succeed, it can no more be said, that all the Colors are necessary to compound White, and that 'tis very probable, that all the rest are nothing but degrees of *Yellow* and *Blew*, more or less charged.

Lastly, touching the Effect of the different Refractions of the Rays in Telescopical Glasses, 'tis certain, that Experience agrees not with what Mr. *Newton* holds. For to consider only a picture, which is made by an object-glass of 12 feet in a dark room, we see, it is too distinct and too well defined to be produced by rayes, that should stray the 50th. part * of the Aperture. So that, (as I believe I have told you heretofore) the difference of the Refrangibility doth not, it may be, alwayes follow the same proportion in the great and small inclinations of the Rayes upon the surface of the Glass.

Compare herewith what Mr. Newton saith in Numb. 80. of these Tracts, page 3079.

Mr. Newtons Answer to the foregoing Letter further explaining his Theory of Light and Colors, and particularly that of Whiteness; together with his continued hopes of perfecting Telescopes by Reflections rather than Refractions.

— Concerning the business of Colors; in my saying that when Monsieur N. hath shewn how *White* may be produced out of two uncompounded colors, I will tell him, why he can conclude nothing from *that*; my meaning was, that such a White, (were there any such,) would have different properties from the White, which I had respect to, when I described my Theory, that is, from the White of the Sun's immediate light, of the ordinary objects of our senses, and of all white *Phænomena* that have hitherto fallen under my observation. And those different properties would evince it to be of a different constitution: Inasmuch that such a production of white would be so far from contradicting, that it would rather illustrate and confirm my Theory; because by the difference of that from other whites it would appear, that other Whites are not compounded of only two colours like that. And therefore if Monsieur N. would prove any thing, it is requisite that he do not only produce out of two primitive Co-

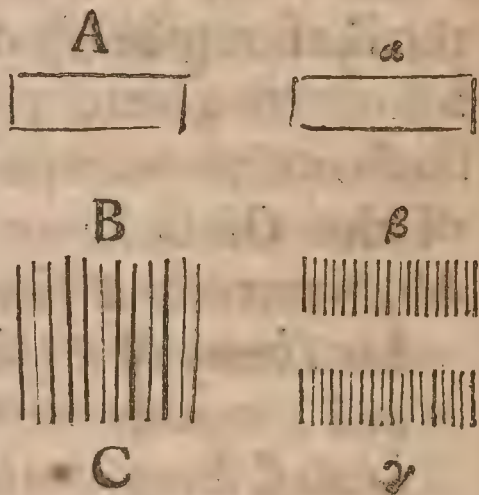
lors.

lors a white which to the naked eye shall appear like other whites, but also shall agree with them in all other properties.

But to let you understand wherein such a white would differ from other whites and why from thence it would follow that other whites are otherwise compounded, I shall lay down this position.

That a compounded color can be resolved into no more simple colors than those of which it is compounded.

This seems to be self evident, and I have also tryed it several ways, and particularly by this which follows. Let α represent an oblong piece of white-paper about $\frac{1}{2}$ or $\frac{1}{4}$ of an inch broad, and illuminated in a dark room with a mixture of two colours cast upon it from two Prisms, suppose a deep blew and scarlet, which must severally be as uncompounded as they can conveniently be made. Then at a convenient distance, suppose of six or eight yards, view it through a clear triangular glass or crystal Prism held parallel to the paper, and you shall see the two colors parted from one another in the fashion of two images of the paper, as they are represented at ϵ and γ , where suppose β the scarlet and γ the blew, without green or any other color between them.



Now from the aforesaid Position I deduce these two conclusions. 1. That if there were found out a way to compound white of two simple colors only, that white would be again resolvable into no more than two. 2. That if other whites (as that of the Sun's light, &c. be resolvable into more than two simple colours (as I find by Experiment that they are) then they must be compounded of more than two.

To make this plainer, suppose that A represents a white body illuminated by a direct beam of the Sun transmitted through a small hole into a dark room, and α such another body illuminated by a mixture of two simple colors, which if possible may

may make it also appear of a white color exactly like A. Then at a convenient distance view these two whites through a Prism, and A will be changed into a series of all colors, Red, Yellow, Green, Blew, Purple, with their intermediate degrees succeeding in order from B to C. But α , according to the aforesaid Experiment, will only yield those two colors of which 'twas compounded, and those not conterminate like the colors at BC, but separate from one another as at ϵ and γ , by means of the different refrangibility of the rays to which they belong. And thus by comparing these two whites, they would appear to be of a different constitution, and A to consist of more colors than α . So that what Monsieur N. contends for, would rather advance my Theory by the access of a new kind of white than conclude against it. But I see no hopes of compounding such a white.

As for Monsieur N. his expression, that I maintain my doctrine with some concern, I confess it was a little ungrateful to me to meet with objections which had been answered before, without having the least reason given me why those answers were insufficient. The answers which I speak of are in the Transactions from pag. 5093 to pag. 5102. And particularly in pag. 5095; to shew that there are other simple colors besides blew and yellow, I instance in a simple or homogeneous Green, such as cannot be made by mixing blew and yellow or any other colours. And there also I shew why, supposing that all colors might be produced out of two, yet it would not follow that those two are the only Original colors. The reasons I desire you would compare with what hath been now said of White. And so the necessity of all colors to produce white might have appear'd by the Experiment pag. 5097, where I say, that if any color at the *Lens* be intercepted, the whiteness (which is compounded of them all) will be changed into (the result of) the other colors.

However, since there seems to have happened some misunderstanding between us, I shall endeavor to explain myself a little further in these things according to the following method.

Definitions.

1. I call that Light homogeneous, similar or uniform, whose rays are equally refrangible.

2. And that heterogeneous, whose rays are unequally refrangible.

Note. There are but three affections of Light in which I have observed its rays to differ, *viz.* Refrangibility, Reflexibility, and Color; and those rays which agree in refrangibility agree also in the other two, and therefore may well be defined homogeneous, especially since men usually call those things homogeneous, which are so in all qualities that come under their knowledg, though in other qualities that their knowledg extends not to there may possibly be some heterogeneity.

3. Those colors I call simple, or homogeneous, which are exhibited by homogeneous light.

4. And those compound or heterogeneous, which are exhibited by heterogeneous light.

5. Different colors I call not only the more eminent species, red, yellow, green, blew, purple, but all other the minutest gradations; much after the same manner that not only the more eminent degrees in Musick, but all the least gradations are esteemed different sounds.

Propositions.

1. The Sun's light consists of rays differing by indefinite degrees of Refrangibility.

2. Rays which differ in refrangibility, when parted from one another do proportionally differ in the colors which they exhibit. These two Propositions are matter of fact.

3. There are as many simple or homogeneous colors as degrees of refrangibility. For, to every degree of refrangibility belongs a different color, by *Prop. 2.* And that color is simple by *Def. 1.* and 3.

4. Whiteness in all respects like that of the Sun's immediate light and of all the usual objects of our senses cannot be compounded of two simple colors alone. For such a composition must be made by rays that have only two degrees of refrangibility, by *Def. 1.* and 3; and therefore it cannot be like that of the Sun's light, by *Prop. 1*; Nor, for the same reason, like that of ordinary white objects.

5. Whiteness

5. Whiteness in all respects like that of the Sun's immediate light cannot be compounded of simple colors without an indefinite variety of them. For to such a composition there are requisite rays indued with all the indefinite degrees of refrangibility, by *Prop. 1.* And those infer as many simple colors, by *Def. 1.* and 3. and *Prop. 2.* and 3.

To make these a little plainer, I have added also the Propositions that follow.

6. The rays of light do not act on one another in passing through the same Medium. This appears by several passages in the *Transactions* pag. 5097, 5098, 5100, and 5101. and is capable of further proof.

7. The rays of light suffer not any change of their qualities from refraction.

8. Nor afterwards from the adjacent quiet *Medium*. These two Propositions are manifest *de facto* in homogeneous light, whose color and refrangibility is not at all changeable either by refraction or by the contermination of a quiet *Medium*. And as for heterogeneous light, it is but an aggregate of several sorts of homogeneous light, no one sort of which suffers any more alteration than if it were alone, because the rays act not on one another, by *Prop. 6.* And therefore the aggregate can suffer none. These two Propositions also might be further proved apart by Experiments, too long to be here described.

9. There can no homogeneous colors be educed out of light by refraction which were not commixt in it before: Because, by *Prop. 7,* and 8, Refraction changeth not the qualities of the rays, but only separates those which have divers qualities, by means of their different Refrangibility.

10. The Sun's light is an aggregate of an indefinite variety of homogeneous colors; by *Prop. 1, 3,* and 9. And hence it is, that I call homogeneous colors also primitive or original. And thus much concerning Colors.

Monsieur N. has thought fit to insinuate, that the aberration of rays (by their different refrangibility) is not so considerable a disadvantage in glasses as I seemed to be willing to make men believe, when I propounded concave mirrors as the only hopes of perfecting Telescopes. But if he please to take his pen and compute the errors of a Glass and Speculum that

collect rays at equal distances, he will find how much he is mistaken, and that I have not been extravagant, as he imagines, in preferring Reflexions. And as for what he says of the difficulty of the praxis, I know it is very difficult, and by those ways which he attempted it I believe it unpracticable. But there is a way insinuated in the *Transactions* pag. 3080. by which it is not improbable but that as much may be done in large Telescopes, as I have thereby done in short ones, but yet not without more than ordinary diligence and curiosity.

A Relation from Dantzick, about an odd effect of Thunder and Lightning upon Wheat and Rye in the Granaries of that City; communicated in a Letter of June 24. 1673. by M. Christ. Kirkby.

S I R,

YOU doubtless know, how much this City is famed for its numerous and convenient Granaries, it being the Repository of all sorts of grain, the fruitful Kingdom of Poland affords. In those Granaries are laid up chiefly Wheat and Rye in parcels, of 20, to 30 and 60 Lasts in one chamber, according to its largeness, and the dryness of the Corn; which they turn over 3, 4, 5, 6 times a week, as need requires to keep it sweet, and fit for shipping. Now it hapned, that about the latter end of *March* and *April* last we had much and violent Thunder and Lightning, which had this unhappy effect upon all the parcels of Wheat and Rye of the last years growth, that, though over-night they were dry, sweet, and fit for shipping, the next morning they had lost all these good qualities, and were become clammy and stinking, and consequently unfit to be ship't away for the present: So that the Owners, if they would not loose their grain, were forced to cause it to be turn'd over two or three times a day, and yet it required six weeks, if not longer, before it was recover'd.

This is a thing, which often happens to Corn that hath not lain in the Granary a whole year, or not swet thoroughly in the straw before it be thrash'd out. An accident little noted, yet in my judgment worth the inquiring into. For, though the Alterations, caused by Thunder in *Liquors*, be taken notice of, and probable reasons given for them; yet I judge this somewhat more abstruse, and therefore more worth while to be consider'd.

*A Relation of an un-common Case in Physick, communicated by
the same from Dantzick in a Letter of March 18.
16 $\frac{72}{73}$.*

S I R,

I Cannot omit acquainting you with an odd Accident, lately come to my knowledge. A Minister of about 50 years of age, being much indisposed, and often relapsing into a distemper accompanied with vomiting and purging, his Physician, when I had the opportunity of speaking with him about it, told me, that he was persuaded, that his cure was obstructed by the Patient's being obliged to study: For when by the help of the medicines, prescribed to and used by him, he was brought to a considerable degree of recovery, his studying and preaching made him constantly relapse. This appearing to me some-what strange, that study and discoursing should cast a man into such violent distempers, and the reasons, given by the Doctor for it, not prevailing with me, he one day surprised me by relating what himself had seen, giving the said Minister a visit, which might confirm his conjecture concerning the Spirits being drawn away from the stomach, and leaving the digestive power languid; which vvas, That the Preacher falling into a relapse after a Sermon preached by him, and Vomits coming strongly upon him, he cast out, amongst other matter, several pieces, some as large as the end of a Mans finger, some less, of a substance, to the touch and eye perfectly resembling Tallow; four pieces vvhich vveighed half an ounce. What may be inferred hence for the doctrine of Concoction, I must leave to others to consider.

JOHANNIS FLAMSTEDII

Derbienſis Angli,

A D

Clariffimum CASSINUM Epiftola,

Novas obſervationes extimarum Elongationum ſiderum Medicæorum à Centro Jovis, novâ ſed & accuratâ ratione habitas, exhibens; adjectis quibuſdam Obſervationibus non-vulgaribus, Planetarum diametros & à Fixis diſtantias, nec non Martis Acronici & Perigei Parallaxin. &c ſpectantibus,

Tibi ignotus ego, Clariffime Caſſine, ſcripturus, tuam audacie meæ veniam pluribus verbis irem exoratum, nî ſtudiorum communium cauſâ mihi Te compellanti, clara tua inter Cæliſpices ingenuitas, & utilitas aliqua obſervationum, quas tibi impertiturus ſum, iſtud omninò ſupervacaneum fore perſuaderent: Novas enim obſervationes, extimarum Elongationum ſiderum Medicæorum à centro Jovis, novâ ſed & exquisitâ ratione factas, qualisque forſan vobis etiamnum non innotuit, conſiderationi tuæ offero; quas propterea ſcire tuâ plurimum intereſſe duxi, quippe ad meſuras Orbium Jovialium Comitum determinandas, nonnihil mihi conferre poſſe videbantur, quorum Te motibus inſtaurandis (quod abſq; juſta Orbium meſura nequit peragi) etiamnum inſudare doctiſſima tua ad Societatem Regiam Epiftola innuit.

Anni duo & amplius elapſi ſunt, ex quo Erudiſſimus Richardus Townleius, Armiger, mihi, tunc hoſpiti ſuo, pro humanitate quâ pollet erga omnes, ſed præſertim Mathematicos, maximas Jovialium ſiderum à centro Jovis digreſſiones, à ſeipſo obſervatas, nec non & motus cujuſque medios, motuumque illorum Radices, ab obſervationibus ejus deductas, Townleio ſuo accommodatas, communicavit. Ab eodem deinceps Ephemeridas tuas Medicæorum ſiderum Anni 1668. impetravi; quibus, quando cum motus tum motuum Radices, nec non & ſummas Elongationes à Te conſtitutas, nonnihil à D. Townleii inventis diſſidere comperui, & Ego, quod ipſe impenſus hortatus eſt, nonnullas primâ quaque occaſione obſervationes inſtituere operæ fore pretium duxi;

duxi; idque non solum ut, num nostræ cum suis, eadem ratione factis observationibus consentirent, sed etiam, ut non diutius precario sed è propriis observationibus & vigiliis ipsas Elongationes investigata tenerem. &, utri vestrum plus faverent cali, haberem exploratum. Tubum habeo longum pedes Anglicanos 14, vitris plano-convexis instructum, cui aded, ab ocul'aribus Micro-metrum, sive aneam ejusdem Dn. Townleii machinam (cujus ope uncia pedis in partes 3507 dividitur) applicui, ut ipsius indices à vitro Objectivo distent pedes $13\frac{2}{3}$ præcisè; aded tamen ut eam, pro re nata, vel dilatare liceat, vel contrahere distantiam; ab Ocularibus tantum 3. Quo instrumento Anno 1672, mense Martii Stil. Jul. sequentia qua potui cura experimenta prima feci; observationibus, in majorem certitudinem, identidem quaque nocte iteratis.

A. 1672. h. . .

Martii 19. 7. 11. Limb. Jovis remotior à 4^{to} satellite dist. 1601 = 9.34.

27. 8. Limbus remotior ab eodem 4^{to} Satel. 1591 = 9.30.

28. 8. Eadem distantia ————— 1598 = 9.33.

Jovis diameter pluribus observationibus reperta 128. Ergo Semidiameter ejus 64; quâ, divisâ distantis observatis, apparentes fient Satellitis à limbo Jovis remotiori distantie in semidiametris ejus,

sd.		sd.
Martii 19. 25—01	Sublatâ semidiam. à centro fient	24—01
27. 24—51		23—51
28. 24—58		23—58

Cujus tunc motus à Jove & distantie à centro ipsius fuere, secundum numeros tuos, ut hîc. Aberat ergo satelles ab extrema elongatione, in prima observatione, tantum

	h. . .	s. . .	sd. . .
Martii 19. 7-11	8-25-33		22-56
27. 8 . . .	2-19-35		22-37
28. 8 . . .	2-11-12		22-24

4'; in secunda, 23'; in tertia, 26', semidiametri scrupulos sexagenarios; quos propterea si observatis Elongationibus modo debito adijciamus, fient maximæ digressiones, hujus 4^{ti} Satellitis, à centro Jovis, per primam Observationem 24^{sd.}—05'; per

se.

secundum, $24^{\text{h}} - 14'$; per tertiam, $24^{\text{h}} - 24'$; quam Tu statuisti tantum 23, R. Townleius 24, 72.

Harum Elongationum posteriores duas accuratiores existimo, quippe quibus investigandis observationes commodas, omni cura poteram, peregi; priorem deinde inter plura noctis 19^æ Adversaria inveni, quam perinde exquisitè captam haud ausim affirmare, quoniam decem alias observationes infra duarum horarum spatium eâ nocte habui; sæpe repetitis omnibus, præterquam Satellitis à Jove, quem quando tunc in maxima Elongatione versari non præsenſeram, semel tantum aut iterum adverti: Utcunque tamen observationem adjeci, quippe quæ non adeò à sequentibus dissentit, quin eas possit confirmare, nec non ostendere, periprimum, (si quicquam) minùs, sinistram quàm dextram versùs hunc Satellitem à Jove elongari.

Sed tamen inter observandum sensi, Aeris & Venti motum, quatiendo vel agitando Tubum, (ad erectam Abietem, ope funis & trochleæ sub dio pensilem) observationem reddere difficilem; quin & frequenter efficere, ut nimis strictas acciperem distantias. Quamobrem à pluribus hujusmodi observationibus, quæ summam curam & præcisionem deprecantur, eoque supersedere constitui, donec commodiorem iis instituendis locum aptarem, quem tandem datâ hac occasione paravi.

Jovis sidere prope 9^{am} m^{rs} elapso mense Martii transituro, ejus quò præcisius ab ea distantias & positiones notarem, ad locum ipsius Acronicum, sed præsertim Orbitæ Inclinationem, plurimum tunc desideratam, inveniendum, in fenestra quadam ligneam machinam, brevis ad instar scalæ, aptari curavi; cujus ope ei impositus Tubus quaquaversum converti potuit, nec à ventis, nisi admodum turbidis, hinc inde, ut sub dio fuit, agitari: huic imposito Tubo, transitum ex voto observavi. Subit deinde animum, omissas observationes Medicæorum repetere, tempusque visum fuit dari aptissimum Aprilis $\frac{4}{14}$ vesperi. Propterea meipsum observationibus tunc omni diligentia peragendis accinxi, nec frustra quidem: Etenim, celo tunc admodum sereno, omnes quatuor Satellites, per Tubum lentium-convexarum, everso situ, quo hîc depinguntur, conspexi, & eorum infra scriptas à limbo Jovis, cuique remotiori, distantias dimensus sum; scil.

4 = 985 iterum 988

2 = 628 . . . 636

1 = 425 . . . 427

4 = 272 . . . 272

Altitudo γ^{vis} quadrante ferè bipedali capta
 $24^{\circ} - 00'$. Ergo hora apparens Derbiæ $8^{\text{h}}. 26'$. p. m. & tunc γ^{vis}
 Satelles infra lineam utrinque per extimos Satellites, ut in figura,
 apparuit; sed vix plenam, ni fallor, semidiametrum.

Jovis diameter, identidem repetitis observationibus, reperta
 133; semidiameter ergo $66\frac{1}{2}$, quæ observatis sublata distantis,
 fient interstitia inter centrum γ^{vis} , & Comitæ primi, 360; se-
 cundi, 569; tertii 921; quarti, 205; quibus per $66\frac{1}{2}$ divisus,
 prodibunt visæ Elongationes à centro Jovis, in ipsius diametris;

sd.				sd.	
1.	5--25	Motus Satellitum à Jove & remotiores apparentes secundum Tuas tabulas, Derbiæ reductas, fuere;	1	9--04--52	4--59
2.	8--33		2	2--12--47	7--57
3.	13--51		3	2--20--26	12--48
4.	3--05		4	5--23--49	2--29

Defecit ergo Satelles primus, 1' tantum; secundus, 3'; tertius
 $12'$ Scrupulis semidiametri sexagenariis à summa Elongatione,
 quos propterea si observatis addamus, fient extremæ Digressi-
 ones,

sd.			sd.		
Primi,	5--26	Quas Tu ponis,	5.	Attamen Dn. Town- leius, ut in schedis aliquibus reperio,	5-31
Secundi,	8--37		8.		8--47
Tertii,	14-02		13.		13--28

Commoda rursus prævisa dari opportunitas Aprilis $\frac{11}{21}$ vespere;
 quamobrem, cum non ab uno aut altero Experimento distantias
 has duxerim definiendas, habitis tunc etiam Observationibus, ul-
 terius mecum inquirere institui; quas cum primum auspicabar,
 celum circa Jovem raris adeò nubibus tectum erat, ut subobscurius
 nonnisi aliquando Satellites potuerim conspicere; quorum tamen
 à limbo Jovis remotiori, ut tulit aer, cepi distantias; nimirum

4 3 — 947.

Hor 7½ p. m.

Iterum 932.

4 2 --- 628.

Rursus 614.

4 4--405, bis ; factō tamen cælo protinus ad votum sereno, accuratius notavi ;

4 3.947.

2.622.

1.405. 4

4.942.



Iterum 957, alto 4^{ve} 24°. 00'. Ergo hora apparens 7^h. 56'. Satelles quartus paulo supra lineam, per primum & secundum ductam, apparuit ; tertius, infra eam, sed & aliquando existimaui in ea. Jovis capta diameter 132, semidiameter ergo 66 ; observatis quæ subducta distantis interstitium dabit inter centrum Jovis & 1, 339 ; secundi, 556 ; tertii, 881 ; quarti, 891 : quibus sigillatim per 66 divisus, prodeunt Elongationes apparentes à centro Jovis in semidiamentris ejusdem, primi quidem, 5^{sd}. 08' ; secundi, 8^{sd}. 25' ; tertii, 13^{sd}. 21' ; quarti, 1^{sd}. 30'.

Satellitum motus medii à Pleni-mediceis, cum distantis eorum

	s	o	sd.
1.	8--15--35--		4--50
2.	1--10--59--		7--34
3.	2--12--02--	12--	22
4.	10--25--08--	13--	15

à centro Jovis, secundum numeros tuos fuere, ut in hac tabellula exarantur. Unde videre est, primum à summa Elongatione abesse scrupulos semidiametri 10' ; secundum, 26' ; tertium, 38' : quos propterea si observatis Elongationibus

adijciamus, fient maximæ hinc deducendæ Digressiones ;

sd.

Primi, 5--18.

Secundi, 8--51.

Tertii, 13--59, per parum ab iis, quas ab Observationibus notis quartæ deduximus, dissentientes.

His tamen utrisque vicibus Intimus Satelles ad levam secundus & tertius ad dextram à Jove apparuere ; sed Aprilis 15, vesperi, tertium à sinistra, in maxima Elongatione appariturum, & primum sub Jove tectum iri, prævidi ; cui propterea phænomeno invigilare operæ fore pretium duxi, nimirum ut perspicerem, num eadem

eadem esset ejusdem Satellitis ad manum utramque à centro Jovis, summa remotio. Cælum nocte observationi ante dicta sudum erat; sic pro voto observavi circa hor. $7\frac{1}{2}$.

4 3. 955.

4^s diam. 131. & deinde 3
Alto Jove.



25°. 00'. i. e. hora 7. 43'. Satelles primus mox Jovem à tergo subiturus, ut hîc, apparuit: $\frac{1}{6}$ circiter diametri à limbo ejus

27°. 20'. ——— 8^h. 06'. subivit Jovem;

27. 26. ——— certè non conspiciebatur; unde motum hujus Comitæ sesqui-gradu minorem quàm ferant tui numeri inveni; num tamen hoc vitium in motibus mediis, latitudine, aut excentricitate Orbitæ Satellitis, nondum bene exploratis, lateat, me fugit. Tu, si ferram hanc reciprocare tibi placet, tuam feres sententiam.

Jovis erat semidiameter $65\frac{1}{2}$, observatæ quâ subductâ distantie, fit interstitium inter centrum Jovis & Satellitem 889: quod per eandem Semidiametrum divisum, visibilem dat Elongationem Comitæ à centro Jovis in Semidiametris ipsius 13^{sd}. 35'.

Motus Satellitis medius erat 3^s. 14°. 09°. Locus Jovis verus 10. 27. Ergo planeta à Pleni-mediceo 9^s. 3°. 42'. aberat à summa Elongatione tantum scrupulos 3'; quos si observatæ digressioni 13^{sd}. 35'. adjiciamus, fiet maxima ad sinistram, hac vice, 13^{sd}. 38'. parte nimirum tertia semidiametri minor, quàm ad dextram, bis conspirantibus notis, observavimus: Quod mihi videtur innuere, esse aliquam Centri orbitæ hujus planeta à centro Jovis Excentricitatem. Utrum tamen sic se res habet, acerrimi tui erit judicii, collatis Eclipsium observationibus, dijudicare.

Machinam sive Micrometrum, quo feci has observationes, N. 29. Phil. Transactionum, sed Anglico idiomate descriptum, videbis; cui si Telescopium pedum 40 vel 50, loco & situ observationibus accommodo, dispositum tenuissem, adeò credo potuissem horum orbium latitudines determinasse, ut nullus meritò majorem præcisionem exspectasset.

Eodem ego, & antedicto Tubo, pedum 14, Planetarum frequenter diametros & à Fixis distantias, ad secundos ferè scrupulos, quod vix inexpertus credes, dimensus sum; unde didici, omnes Astronomos etiamnum, unum præterquam Horroccium,

in Lunæ systematibus ordinandis longè à vero aberrasse. Quid quòd & Parallaxin Martis Acronici & Perigei nunquam majorem esse scrupulis secundis 25'; Unde sequitur, Solis esse summum 10", & distantiam 21000 Terræ semidiametros. Inveniemus etiam Inclinationis orbitæ Jovis ad Eclipticam præcisam quantitatem, si modò dabitur unquam Fixæ cujusdem certa latitudo. Etenim pluribus argumentis evinci potest, Tychonem sæpe cum in locis, tum latitudinibus, Fixis quibusdam assignatis, duos tresve & interdum quatuor aut quinque totos scrupulos à vero aberrasse, qui donec sublati fuerint errores, frustra cælestibus factis observationibus, utcumque numeros disposuerimus, satisfacere studebimus. Fixarum quidem restitutionem suscepisse celeberrimum Johannem Hevelium audivimus, attamen quandoquidem pinnacidis vitrorum cassis fertur ipsum uti; dubium, an multum ab ipso emendati-ores locos habituri simus quàm reliquit Tycho, nisi ubi valde hallucinatus est. Utinam à vobis in Gallia hæc correctio instauretur. Summa de Genio gentis Gallicæ, quin & de Te, Vir Clarissime, sperabimus. Vale, & si quæ è nostris observationibus usui Tibi esse possint, fac modò per amicum communem sciam, & tui protinus Juris faciam; imò quicquid posthac etiam observare poterit

*Derbiæ,
July $\frac{7}{17}$ 1673.*

Tui Cultor devotissimus

Johannes Flamstedius.

An Account of a Book.

Several TRACTS written by the Honourable Robert Boyle; of the strange Subtilty, Efficacy, and determinate Nature of EFFLUVIUMS; of New experiments to make the parts of FIRE and FLAME Stable and Ponderable; together with some Additional Experiments about Arresting and Weighing of Igneous corpuscles; as also a Discovery of the Perviousness of Glass to Ponderable parts of Flame, with some Reflexions on it by way of Corollary.

How important these *New Tracts* are to natural Philosophy, the Considering Reader will soon find upon an attentive perusal of them.

In the *First* of which, touching *Effluvia*, he will meet, *First*, with divers Experiments and Observations, proving their wonderful *Subtilty*, and referible to one of the following Heads: *viz.* The strange Extensibility of some Bodies whilst their parts yet remain tangible: The multitude of visible corpuscles that may be afforded by a small portion of matter: The smallness of the Pores at which the *Effluvia* of some Bodies will get in: The small decrement of Bulk or Weight, that a Body may suffer by parting with great store of *Effluvia*: The great quantity of space that may be filled, as to sense, by a small quantity of matter when rarified or dispersed.

Secondly, with several Considerations, evincing the great *Efficacy* of *Effluvia*, notably operating upon one another, by at least six wayes: 1. By the Great Number of emitted corpuscles. 2. By their penetrating and pervading nature. 3. By their *Celerity*, and other modification of their Motion. 4. By the *Congruity* and *Incongruity* of their Bulk and Shape to the Pores of the Bodies they are to act upon. 5. By the *Motions* of one part upon another, that they excite or occasion in the Body they work upon according to its structure. 6. By the Fitness and Power they have to make themselves to be assisted in their working by the more *Catholick Agents* of the Universe.

Thirdly, with particular Instances of the *Determinate nature* of Effluvia, reduced to three Heads. 1. That these *Effluvia* being by Condensation or otherwise re-united, they appear to be of *the same* nature with the Body that emitted them. 2. We may discover their *Determinate nature* by the difference that may sometimes be observ'd in their Sensible Qualities; forasmuch as those *Effluvia* that are endowed with them, proceed from the same sort of Bodies, and yet those afforded by one kind of bodies, being in many cases manifestly differing from those that fly off from another, this evident disparity in their exhalations argues their retaining distinct natures, according to those of the respective Bodies whence they proceed. 3. We may discover this *Determinate nature* of Effluvia from their Effects upon other Bodies than the Organs of our Senses; considering, that the Effects which certain Bodies produce on others by their Effluvia, being constant and determinate, and oftentimes very indifferent from those, which other Agents by their Emissions work upon the same and other subjects, the distinct nature of the Corpuscles emitted may be thence sufficiently gathered. The instances produced to make out this particular, are concluded with an Experiment shewing to the very Eye, That *Effluvia* elevated without the help of Heat, and wandering in the Air, may *both* retain their own nature, and upon *Determinate Bodies* produce effects, that a vulgar Philosopher would ascribe to *Occult Qualities*.

In the *second Tract*, containing *New Experiments to make the Parts of Fire and Flame stable and ponderable*, the Noble author himself acquaints us with the Motive, Design, and Parts thereof. He consider'd then, that there being a very vast disproportion between the Diaphanous part of the World, and the Globes swimming therein; and the nature of Diaphanous bodies being such, that when the Sun or any other Luminous Body illustrates them, the Light does so penetrate and mix it self *per minima* with them, that there is no sensible part of the transparent Body un-inlighten'd; it would be worth the enquiry, Whether a thing so vastly diffused as *Light* is, were something Corporeal or not; and

and whether, in case it be, it might be subjected to some other of our Senses besides our *Sight*, whereby we might examine, whether it had any affinity with other Corporeal Beings that we are acquainted with here below?

He further taking notice of the Disputes between the *Peripateticks*, *Cartesians*, and *Atomists* of old, concerning the nature of Light, whether it be a meer Quality, or a Modification of Motion in an *Æthereal* matter, or a Corporeal substance; and doubting, Whether the Corporeity of Light would be in hast determin'd by meer *Ratiocinations*: He thought it very well worth the endeavouring to try, Whether he could do any thing towards clearing the dispute of it by *Experiments*; especially being perswaded, that, if such an attempt should prove successful, the consequences of it would be very great and useful towards the explicating of divers *Phænomena* in divers parts of Natural Philosophy, as in *Chymistry*, *Botanicks*, and, (if there be any such) the allowable part of *Ætology*.

Now to compass what he aimed at, he intended *first* to try, what he could do by the *Union of Sun-beams*; and then, what could be obtain'd from *Flame*. But having been hitherto disappointed by the cold and wet weather from prosecuting his attempts with the *Sun-beams*, so far at least as to build on them as yet, and therefore reserving an account of them for another opportunity; he recites in this Essay that sort of Experiments, which depending less on Casualties, 'twas more in his power to bring to an issue, *viz.* those made with *Flame*; of which he hath delivered a good number, willing to contribute something towards the History, that now perhaps will be thought fit to be made of the Increase or Decrement, that particular Bodies may receive by being exposed to the Fire; considering also, that the Incongruity of the Doctrine here asserted to the Opinions of the Schools, and the general Prepossessions of Mankind, made it fit by a considerable variety and number of Experiments to obviate, as far as might be, the differing Objections and Evasions, wherewith a Truth so paradoxical may expect to be excountered. Certain it is, that this Discovery cannot but excite the Inquisitive to exercise their sagacity in finding out, what kind of

of substance that is, which, though hitherto overseen, and being a Fluid far more subtile than visible Liquors, and able to pierce into the Compact and Solid bodies of Metals, can yet add something to them, that has no despicable weight upon the Ballance, and is able for a considerable time to continue fixt in the Fire.

This part is follow'd by some *Additional Experiments* about *Arresting and Weighing of Igneous Corpuscles*; which since they shew, that what is afforded by Fire may in a corporeal way invade, adhere, and add Weight to even fixt and ponderous Bodies, do thereby open a large field to the Speculative to apply this discovery to divers *Phænomena* of Nature and Chymistry.

After this he proceeds to another Discovery, which is of the *Perviousness of Glass to Ponderable Parts of Flame*. And here, that he might not only obviate some scruples that may be entertain'd by suspicious Wits upon that Circumstance of the preceding *Additional Experiments*, viz. *That the Glasses employed about them were not exposed to the action of meer Flame, but were held upon Charcoals*; which may seem to contain but a grosse kind of Fire; but also that by diversifying the way of tryal, he might render such Experiments both more fit to afford Corollaries, and more serviceable to his other purposes; He attempted to make it succeed with a Body so thin and disengaged from gross matter, as meer Flame is allow'd to be, knowing, that by going cautiously with it to work, one might handle a Retort without breaking it, in spite of a violent agitation of kindled matter.

Meantime, by the Experiments here recited concerning this argument, the Author pretends not to make out the *Porosity of Glass* any further, than is exprest in the Title of this Discours, namely, in reference to some of the *Ponderable Parts of Flame*. For he thinks not Glass to be easily penetrable either by Chymical Liquors, or by Quicksilver, or at least by our Air. Again, having compared the increase, he observ'd to be made in the Weight of the Bodies exposed by him to the naked Fire, and those of the same or the like kind, included by him in Glasses, or so much as in Crucibles; he esteems it worth considering, Whether this difference in acquired Weight may not

not give cause to suspect, that the Corpuscles, whereof Fire and Flame consists, are not all of the same size, and equally agitated, but that the interposed vessel keeps out the grosser particles like a strainer, though it lets pass the minutest and most active? He further offers it to consideration, Whether the Perviousness of Glass, even to the minute particles that pervade it, and their adhesion to the metal they work on, does necessarily imply Pores *constantly* great enough to transmit such Corpuscles? Or, Whether it may not be said, *that* Glass is generally of a closer texture, than when in his Experiments the Pores are opened by the vehement heat of the Flame that beats upon it, and in that State may let pass corpuscles too big to permeate Glass in its ordinary State; and *that* this penetration is much assisted by the vehement agitation of the igneous parts, which by the rapidness of their motion both force themselves a passage through the narrow Pores of the glass, and pierce deep enough into those of the included body to stick fast there.

But by all these Experiments the Author professes himself not to be so far satisfied, as *either* to determine, whether the rectitude, by some supposed in the Pores of Glass as 'tis a transparent body, or rather in their ranks or rows, may facilitate the Perviousness by him observ'd in Glass, or to conclude from them, that Ponderable parts of Flame will be able as well to pass through the Pores of Metallin vessels as those of Glass.

Having given these Advertisements, to prevent the drawing of unsafe consequences from his Experiments, he subjoyns three or four *Corollaries* that may more warily be deduced from them. The *first* confirms, that Flame may act as a *Membrum*, and make Coalitions with the bodies it works on. The *second* proposeth a Paradox about *Calcination* and *Calces*. The *third* shews, that neither the *Epicurean* hypothesis, supposing a penetration of the igneous particles through the Pores of the Glass; nor the *Cartesian* doctrine, teaching the operation of the fire to be perform'd by the vehement agitation of the small parts of the glass, and by them propagated to the included bodies; that neither of these, *I say*, do seem to hit the mark. The *fourth*, That bodies very spirituous, fugitive

tive and minute, may, by being associated with congruous particles, though of quite another nature, so change their former Qualities, as to be arrested by a solid and ponderous body, to that degree as not to be driven away from it by a fire intense enough to melt and calcine metals.

Advertisement.

The Reader is herewith desired to take notice, that the next of these Transactions will not appear abroad till about the end of October next.

Errata left uncorrected in N^o. 95.

Pag. 6060. l. 16. r. *Cerebellum*. Pag. 6062. l. 1. r. *within the*.
 Pag. 6068. l. 16. r. 12. d. Pag. 6069. l. 5. r. *Evolution*.
 Pag. 6070. l. 15. r. *he premiseth*. Pag. 6071. l. 1 r. *and having*.
ibid. l. 24. r. *Ricciolus*. Pag. 6074. l. 11. r. *Models*.

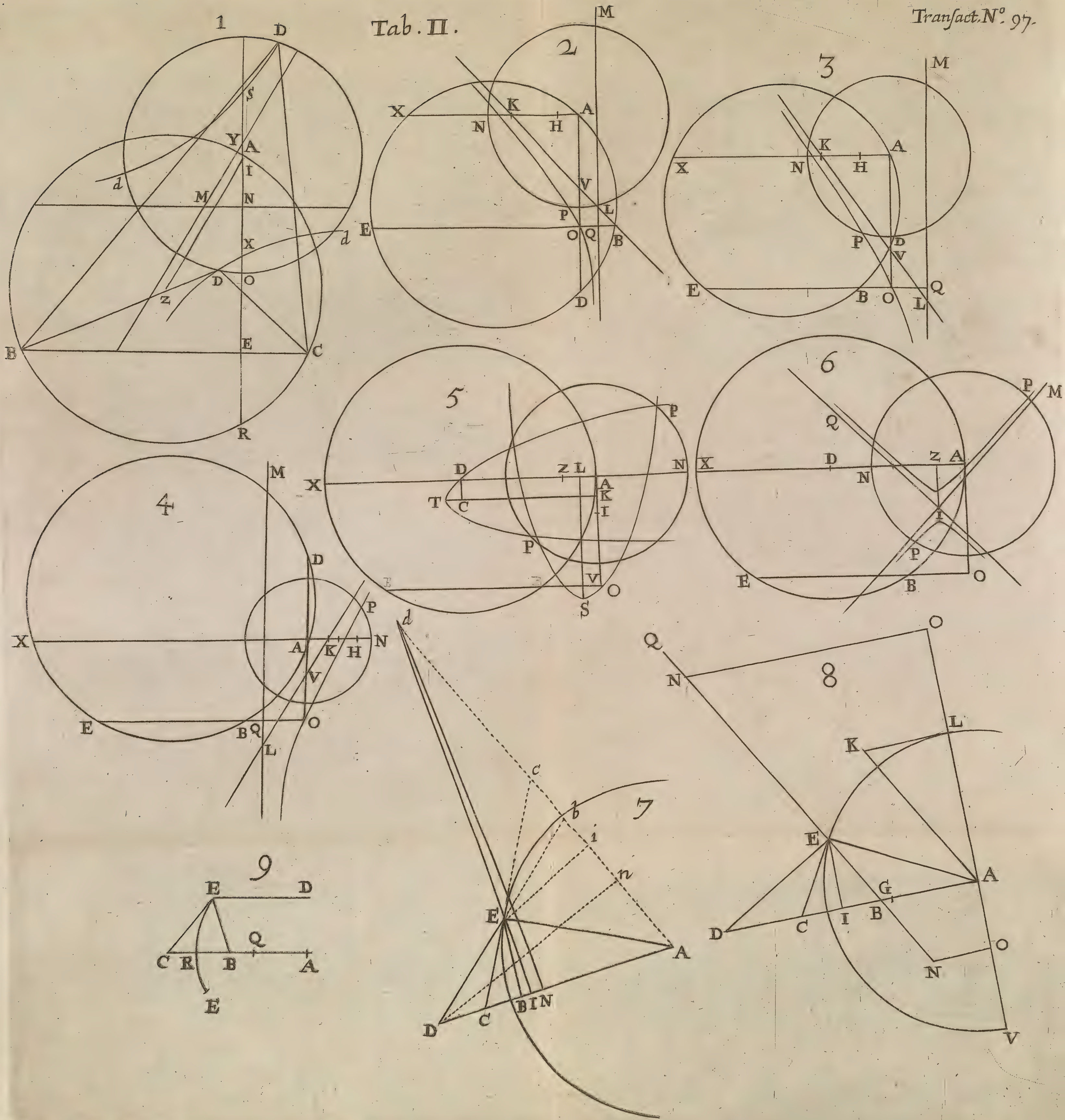
Errata in this Numb. 96.

Pag. 6081. l. 42. r. *propiores*. Pag. 6082. l. 13. r. *huic malo apparenti*. *ibid.* l. 37. r. *& relatum*. *ibid.* l. 44. rr *sum Orthographicè*, pro, *Geographicè*. Pag. 6096. l. 1. r. *secundam*.

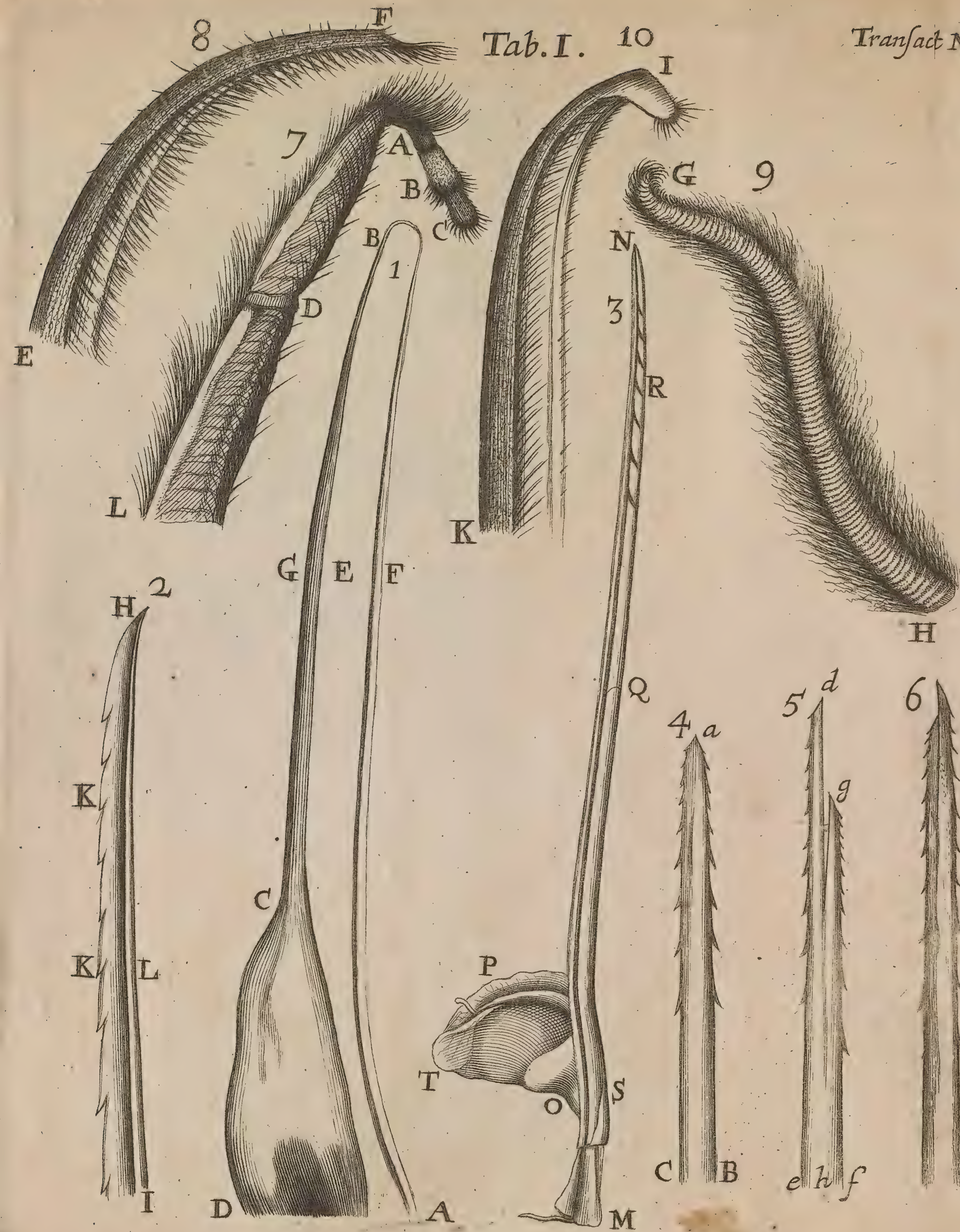
L O N D O N,

Printed for John Mariyn, Printer to the R. Society 1673.

Tab. II.









PHILOSOPHICAL TRANSACTIONS.

For the Months of *August, September and October.*
Octob. 6. 1673.

The CONTENTS.

Extracts of two Letters, the one of Mr. Newton, concerning the Number of Colors, and the Necessity of mixing them all for the production of White, &c; the other, of a Philosopher at Paris, by way of Answer to the former. A Letter of the Honorable Robert Boyle concerning the Vegetable nature of Amber-Greece, according to an Extract taken out of a Dutch East-Indian Journal. A Letter about the success of the Royal Styptique water in the Fleet. The Figures of some New Microscopical Observations, together with the Description of them, concerning some parts in Bees, not discover'd before. Some Letters exchanged between Monsieur Slusius and Monsieur Hugenius, about a considerable Optic Problem of Alhazen. An Account of four Books : I. Tracts consisting of Observations about the Saltness of the Sea; an Account of a Statical Hygroscope and its Uses; an Appendix about the Force of the Air's moisture; as also a Discourse of the Natural and Preternatural State of Bodies; by Robert Boyle Esq; To all which is premised a Sceptical Dialogue about the Positive or Privative nature of Cold, by a Member of the R. Society. II. Principia & Problemata aliquot Geometrica, antè desperata, nunc breviter explicata & demonstrata, Auth. T. H. Malmesburiensi. III. An Idea of a Phytological History; together with a Continuation of the Anatomy of Vegetables, particularly of Roots; and an Account of the Vegetation of Roots; by Nehemiah Grew M.D. and Fellow of the R. Society. IV. Thomæ Bartholini Acta Medica & Philosophica.

An Extract of Mr. Isaac Newton's Letter, written to the Publisher from Cambridge April 3. 1673. concerning the Number of Colors, and the Necessity of mixing them all for the production of White; as also touching the Cause why a Picture cast by Glasses into a darkned room appears so distinct notwithstanding its Irregular refraction: (Which Letter, being an Immediate answer to that from Paris, printed N°. 26. p. 6086. of these Tracts, should also, if it had not been mis-laid, have immediately followed the same.)

IT seems to me, that N. takes an improper way of examining the nature of *Colors*, whilst he proceeds upon compounding those that are already compounded; as he doth in the former part of his Letter. Perhaps he would sooner satisfy himself by resolving Light into Colors, as far as may be done by Art, and then by examining the properties of those colors apart, and afterwards by trying the effects of re-conjoining two or more or all of those; and lastly, by separating them again to examine, what changes that re conjunction had wrought in them. This, I confess, will prove a tedious and difficult task to do it as it ought to be done; but I could not be satisfied, till I had gone through it. However, I only propound it, and leave every man to his own method.

As to the Contents of his Letter, I conceive, my former Answer to the *Quere* about the Number of *Colors* is sufficient, which was to this effect; That all Colors cannot practically be derived out of the *Yellow* and *Blew*, and consequently that those *Hypotheses* are groundless which imply they may. If you ask, What colors cannot be derived out of *yellow* and *blew*? I answer, none of all those which I defin'd to be Original; and if he can shew by experiment, how they may, I will acknowledge my self in an error. Nor is it easier to frame an *Hypothesis* by assuming only two Original colors rather than an indefinite variety; unless it be easier to suppose, that there are but two figures, sizes and degrees of velocity or force of the *Æthereal* corpuscles or pulses, rather than indefinite variety; which certainly would be a harsh supposition. No man wonders at the indefinite variety of Waves of the Sea, or of sands on the shore; but,

but, were they all but two sizes, it would be a very puzzling *phenomenon*. And I should think it as unaccountable, if the several parts or corpuscles, of which a shining body consists, which must be suppos'd of various figures, sizes and motions, should impress but two sorts of motion on the adjacent *Æthereal medium*, or any other way beget but two sorts of Rays. But to examine, how Colors may be explain'd *hypothetically*, is besides my purpose. I never intended to shew, wherein consists the Nature and Difference of colors, but only to shew, that *de facto* they are Original and Immutable qualities of the Rays which exhibit them; and to leave it to others to explicate by Mechanical *Hypotheses* the Nature and Difference of those qualities: which I take to be no difficult matter. But I would not be understood, as if their Difference consisted in the Different Refrangibility of those rays; for, that different Refrangibility conduces to their production no otherwise, than by separating the Rays whose qualities they are. Whence it is, that the same Rays exhibit the same Colors when separated by any other means; as by their different *Reflexibility*, a quality not yet discoursed of.

In the next particular, where N. would shew, that it is not necessary to mix all Colors for the production of *White*; the mixture of *Yellow*, *Green* and *Blew*, without *Red* and *Violet*, which he propounds for that end, will not produce *White*, but *Green*; and the brightest part of the *Yellow* will afford no other colour but *Yellow*, if the Experiment be made in a room well darkn'd, as it ought; because the Colour'd light is much weaken'd by the Reflexion, and so apt to be diluted by the mixing of any other scattering light. But yet there is an Experiment or two mention'd in my Letter in the *Transactions* Numb. 88, by which I have produced *White* out of two colors alone, and that variously, as out of *Orange* and a full *Blew*, and out of *Red* and pale *Blew*, and out of *Yellow* and *Violet*, as also out of other pairs of Intermediat colors. The most convenient Experiment for performing this, was that of casting the colors of one *Prisme* upon those of another, after a due manner. But what N. can deduce from hence, I see not. For the two colors were compounded of all others, and so the resulting *White*, (to speak properly,) was compounded of them all,

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and

and only de-compounded of those two. For *instance*, the *Orange* was compounded of Red, Orange, Yellow and some Green; and the *Blew*, of Violet, full Blew, light Blew, and some Green, with all their Intermediat degrees; and consequently the Orange and Blew together made an Aggregate of all colors to constitute the White. Thus, if one mix red, orange and yellow Powders to make an Orange; and green, blew and violet colors to make a Blew; and lastly, the two mixtures, to make a Grey; that Grey, though de-compounded of no more than two Mixtures, is yet compounded of all the six Powders, as truly as if the powders had been all mixt at once.

This is so plain, that I conceive there can be no further scruple; especially to them who know how to examine, whether a colour be simple or compounded, and of what colors it is compounded; which having explained in another place, I need not now repeat. If therefore N. would conclude any thing, he must shew, how White may be produced out of two *Un-compounded* colors; which when he hath done, I will further tell him, why he can conclude nothing from that. But I believe, there cannot be found an Experiment of that kind; because, as I remember, I once tryed, by gradual succession, the mixture of all pairs of Un-compounded colors; and, though some of them were paler, and nearer to White, than others, yet none could be truly call'd White. But it being some years since this tryal was made, I remember not well the circumstances, and therefore recommend it to others to be tryed again.

In the last place, had I thought, the Distinctness of the Picture, which (for *instance*) a Twelf foot Object-glass casts into a darken'd room, to be so contrary to me as N. is pleas'd to affirm, I should have waved my Theory in that point before I propounded it. For, that I had thought on that difficulty,

* See Numb. 80.
p. 3079.

you may easily guess by an expression, somewhere in my first Letter *, to this purpose; That I wonder'd, how Telescopes could be brought to so great perfection by Refractions which were so Irregular. But, to take away the difficulty, I must acquaint you, *first*, That, though I put the greatest Lateral error of the rays from one another to be about $\frac{1}{50}$ of the Glasses diameter; yet their greater error from the Points on which they ought to fall, will be
but

but $\frac{1}{100}$ of that diameter : And *then*, that the rays, whose error is so great, are but very few in comparison to those, which are refracted more Justly ; for, the rays which fall upon the middle parts of the Glass, are refracted with sufficient exactness, as also are those that fall near the *perimeter* and have a *mean* degree of Refrangibility ; So that there remain only the rays, which fall near the perimeter and are *most* or *least* refrangible to cause any sensible confusion in the Picture. And these are yet so much further weaken'd by the greater space, through which they are scatter'd, that the Light which falls on the due point, is infinitely more dense than that which falls on any other point round about it. Which though it may seem a *Paradox*, yet is certainly demonstrable. Yea, although the Light, which passes through the middle parts of the Glass, were wholly intercepted, yet would the remaining light convene infinitely more dense at the due points, than at other places. And by this excess of Density, the Light, which falls *in* or invisibly *near* the just point, may, I conceive, strike the *sensorium* so vigorously, that the impress of the weak light, which errs round about it, shall, in comparison, not be strong enough to be animadverted, or to cause any more sensible confusion in the Picture than is found by Experience.

This, I conceive, is enough to shew, Why the Picture appears so distinct, notwithstanding the Irregular refraction. But, if this satisfy not, N. may try, if he please, how distinct the Picture will appear, when all the *Lens* is cover'd excepting a little hole next its edge on one side only : And, if in this case he please to measure the breadth of the colors thus made at the edge of the Sun's picture, he will perhaps find it to approach nearer to my proportion than he expects.

An Answer (to the former Letter,) written to the Publisher June 10. 1673. by the same Parisian Philosopher, that was lately said to have written the Letter already extant in N^o. 96. p. 6086.

T Ouching the Solutions, given by M. Newton to the scruples by me propos'd about his Theory of Colors, there were matter to answer them, and to form new difficulties; but seeing that he maintains his opinion with so much concern, I list not to dispute. But what means it, I pray, that he saith; *Though I should shew him, that the White could be produced of only two Un-compounded colors, yet I could conclude nothing from that.* And yet he hath affirm'd in p. 3083. of the *Transactions*, that to compose the White, all primitive colors are necessary.

As to the manner, whereby he reconciles the effect of Convex glasses for so well assembling the rays, with what he establishes concerning the different refrangibility, I am satisfied with it; but then he is also to acknowledge, that this aberration of the rays is not so disadvantageous to Optic glasses as he seems to have been willing to make us believe, when he proposed *Concave speculums* as the only hopes of perfecting Telescopes. His invention certainly was very good; but, as far as I could perceive by experience, the defect of the Matter renders it as impossible to execute, as the difficulty of the Form obstructs the use of the *Hyperbole* of M. Des-Cartes: So that, in my opinion, we must stick to our Spheric Glasses, whom we are already so much obliged to, and that are yet capable of greater perfection, as well by increasing the length of Telescopes, as by correcting the nature of Glass it self. *So far He.*

To this Letter is to be referr'd that, which is already extant in N. 96. p. 6087. as being an Answer thereto.

A Letter of the Honorable Robert Boyle of Sept. 13. 1673. to the Publisher, concerning Amber Greece, and its being a Vegetable Production.

S I R,

Some occasions calling me this afternoon up to London, I met there with a very Intelligent Gentleman, who was ready to go out of it ; but before he did so, he willingly spar'd me some time to discourse with him about some of the Affairs of our East-Indian Company, of which he was very lately Deputy Governour; and, his year being expired, is still one of the chief of the Court of Committees, which a forreigner would call Directors that manage all the affairs of that considerable Society. And among other things talking with him about some Contents of a *Journal* lately taken in a Dutch East-Indian prize, I learnt from him, that he, who understands that language very well, is now perusing that Manuscript, and, among many things recorded there that concern the Orconomical and Political affairs of the said Dutch company, he met with one *Physical* Observation which he thought so rare, that remembring the curiosity I had exprest for such things, he put it into English, and transcrib'd it for me, and immediatly drawing it out of his pocket he presented me the short paper, whereof I now shew you the Copy : Upon perusal of which, you will very easily believe, that not only his Civility oblig'd me, but the Information it brought me surpriz'd me too. For, the several tryals and observations of my own about *Amber Greece* have long kept me from acquiescing either in the vulgar opinions, or those of some Learned men concerning it ; yet I confess, my Experiments did much less discover what it is, than this paper has done, in case we may safely and intirely give credit to its Information, and that it reach to all kinds of *Ambergreece*. And probably you will be invited to look on this account, though not as compleat, yet as very sincere, and on that score Credible, if you consider, that this was not written by a Philosopher to broach a *Paradox*, or serve an *Hypothesis*, but by a Merchant or Factor for his Superiors, to give them an account of a matter of fact ; and that this passage is extant in an authentick *Journal*, wherein the affairs of the Company were by

by publique order from time to time register'd at their chief Colony *Batavia*. And it appears by the paper it self, that the Relation was not look'd upon as a doubtful thing, but as a thing from which a practical way may be deduc'd to make this Discovery easily Lucriferos to the Dutch Company. And I could heartily wish, that in those Countreys that are addicted to long Navigations, more notice than is usual were taken and given of the Natural Rarities that occur to Merchants and Sea-men. On which occasion I remember, when I had, in compliance with my Curiosity, put my self into our East-Indian Company, and had, by their Civility to me, been chosen of their Committee as long as my Health allowed me to continue so, I had the opportunity in some Register books of Merchants, *English* and *Dutch*, to observe some things, which would easily justify this wish of mine, if my haste and their Interest would permit me to acquaint others with them. But to return to our Accompt of *Amber-greece* I think you will easily believe, that, if I had received it not by a Paper but immediately from the Writer, I should, by proposing divers Questions, have been enabled to give you a much more satisfactory account than this short one contains. But the obliging person that gave it me, being just going out of Town, I could not civilly stay him to receive my *Quere's* about it; which though (God permitting) I may propose ere long, if I can light on him again, yet I fear he has given me, in these few lines, all that he found about this matter. However this Relation as short as it is, being about the Nature of a drug so precious and so little known, will not, I hope, be unwelcome to the Curious; to whom none is so like to convey it so soon and so well as Mr. O; whose forwardness to oblige others by his various Communications challenges Returns of the like nature from others, and particularly from his Affectionate Humble servant.

Follows

Follows the Extract it self out of a Dutch Journal, belonging to the Dutch East-Indian Company.

A Mber-Greece is not the Scum or Excrement of the Whale, &c. but issues out of the Root of a Tree, which Tree how far soever it stands on the Land, alwaies shoots forth its roots towards the Sea, seeking the warmth of it, thereby to deliver the fattest Gum that comes out of it: Which tree otherwise by its copious fatness might be burnt and destroyed. Wherever that fat Gum is shot into the Sea, it is so tough, that it is not easily broken from the root, unless its own weight and the working of the warm Sea doth it, and so it floats on the Sea.

There was found by a Souldier $\frac{7}{8}$ of a pound, and by the chief, two pieces weighing *five* pounds. If you plant the Trees where the stream sets to the shore, then the stream will cast it up to great advantage. *March 1. 1672. in Batavia,*
Journal Advice from ———

A Letter to the Publisher written by one of the principal Chirurgions of his Majesties Fleet, concerning the further success of the Blood-stanching liquor, formerly taken notice of.

S I R,

I Doubt not but you have heard, with what admirable success the Royal Styptique liquor was used in the last engagement against the Dutch by the Chirurgions of the Earl of Ossory, Sir Edward Spragg, and Sir John Berry, and others. A very good Physitian in *Tarmouth*, several credible persons also in *London* and other places (some of whom have taken it inwardly themselves) do give the like commendation of it for stopping bleeding upon Eruption or Apertion of a vessel in the Lungs or other Internal parts, being administred according to the printed direction.

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The Figures of some of Mr. Leewenhoecks Microscopical Observations, formerly publish't (in Numb. 94. p. 6037. 6038.) together with their Explication.

THis Curious observer, having been desired by the Publisher, since his first Communications, already printed in these Papers, that, for further satisfaction, he would please to transmit the *Figures* of what he had so well observed, and he having not only very obligingly complied with that desire, but also added New Observations; we thought ourselves bound to do him right in publishing both the *Figures* of his former Communications, and his Additions thereunto; though for this time we must content our selves only with the former of these, reserving the latter for another opportunity. And in the Explication of these *Figures* we shall here give you in English, what the observer sent us in Dutch.

See *T A B. I.*

IN *Fig. 1.* A B is the great Sting, or rather the Sheath or Case of the Bee, out of which were taken the two Stings (for, that the Bee hath two, this observer formerly acquainted us with;) E is the cavity of the sheath, in which the two stings, by and by to be described, lye; like a quill pulled out of a fowl's wing, and of that cut off a third part in length, and by its sides bent a little inwards towards E. D is the thickness of the Case beneath: And about D A the two Stings shew themselves, each in a place by it self; which I have seen my self, when I broke this thick part of the Sheath in pieces.

In *Fig. 2.* H I is part of the Sting taken out of the Sheath A B, which appears a little side ways; whence it is, that the crooks or forks K K do not show so big nor sharp, as indeed they are. L. is the back of the sting without forks; which side or back is almost as broad as one of the sides of the sting, when the crooks appear.

In *Fig. 3.* *M N* is the whole Sting, taken also out of the Sheath *AB* in *Fig. 1.*, and with its back, which is without forks (as hath been shewn in *Fig. 2.* by *L.*) turn'd to the Eye. Here the crooks shew themselves, (though turn'd from the Eye) through the Sting, as appears by *R.* The upper part of the Sting *NQ* is closed round about, and hollow within; and the lower part *QS* is open. *SM* is a part of the broken sinew, which is very near as long as the whole sting; and when it can be taken whole out of the body, it contracts it self into the shape of a half Moon, and appears of the colour of a Tortoise-shell, as also doth the Sting it self. *OP* is the body fastned to the Sting, and placed in the thicker part of the Case *DCA* (in the *first Figure*) to wit, *S* about *A*, and *T* towards *D*.

In *Fig. 4.* *abc* are both the Stings, as they lye together before, close against the sheath; yet is one of them a little higher than the other: And forasmuch as at *a* there is yet seen a little of the sheath, here both the stings seem to be one, furnish't on both sides with crooks.

In *Fig. 5.* *edgfb* are both the Stings, in part out of their Sheath; yet doth the sting *edh* stand a little higher out of the case than the sting *gfb*. Thus have I found them to lye in their sheath, when they are at rest.

In *Fig. 6.* Two stings, standing also a little out of the sheath. As to the motion of these Stings, I conceive it thus to be made: First, the Bee draws her sheath, together with its stings out of the body, and endeavors to thrust it as far as she can into the body she will sting, together with one of the stings, which at that time she draws out of the case: which sting when she is drawing back again, but it not being able, by reason of the crooks, to return, she pulls the sheath and the other sting deeper into the body. Now it is that she useth her other sting, which she then thrusts also into the body as deep as she can, and then endeavors to pull that back also; by which pulling back she thrusts her sheath and first sting yet deeper into the body: And this she continues so long till she gets both the stings and the sheath, as far as to the thick part of the sheath, into the body; which done, the stings need no more motion out of the sheath, when the

body of the sting (in *Fig. 3.*) O T P in the thickness of the sheath C D A (in *Fig. 1.*) can move from C to D.

And so much for the *Stings* of the Bee. Let us now see how our Observer explains his *Figures*, representing the several *artus* or limbs, he hath taken notice of about the Head of a Bee; which were also briefly mentioned in the aforesaid *Numb. 94.*

See then the same TABLE I. *Fig. 7.* where L D A B C is one of the two small limbs, which the Bee hath on the fore-part of her Head, and which he calls *Arms*, wherewith he judges she makes her Hony-combs, each furnish't with three peculiar joints, as at D, A, B.

In *Fig. 8.* E F is one of the two small limbs, which the Bee hath likewise on the fore-part of her Head, by him called *Scrapers*, by the help of which, he conceives, she scrapes the wax from flowers.

In *Fig. 9.* G H is the small limb, which is also placed before on her head, and is by him call'd the *Wiper*, wherewith he conjectures she wipes off the Hony from the flowers.

Fig. 10. K N represents the *Scraper* of a wild Bee, which he exhibits here with the rest, because it is of a different make from the Scraper of a tame Bee, above in *Fig. 8.*

The remainder of this Authors Observations, which are chiefly about the Structure of Plants, and the contrivance of Nature to make them shoot and grow upwards, we must refer to another Month; being obliged to employ the rest of this *Tract* in publishing some Letters that have been exchanged between two Eminent Mathematicians about a considerable Optic Problem of *Alhazen*; as also in giving an account, according to our custom, of some new Philosophical Books, lately come out of the Press.

Excerpta ex Epistolis non-nullis, ultrò citròque ab Illustrissimis Viris, *Slusio* & *Hugenio*, ad Editorem scriptis, de famigerato *Alhazeni* Problemate circa Punctum Reflexionis in Speculis cavis aut convexis; & primò quidem ex Prima *Hugenii*, 26 Junii 1669. scripta:

— **M**itto Tibi hac occasione Constructionem Problematis *Alhazeni* nuper à me inventam, & à Collegis meis felicem satis judicatam. Problema est;

Dato Speculo cavo aut convexo, itemque oculo & puncto rei visæ, invenire Punctum Reflexionis.

Esto Speculum ex Sphæra quæ Centrum habeat *A* punctum, oculus vero sit in *B*, & punctum visibile in *C*, plana- Vid. Tab. II.
Fig. I.
nūmque ductum per *A, B, C*, faciat in sphæra circulum
D d, in quo invenienda sint Reflexionis puncta. Per tria puncta *A, B, C*, describatur circuli circumferentia; cujus sit centrum *Z*, occurrat autem ei producta *AE*, perpend. *BC* in *R*, & sit duabus *RA, OA*, tertia proportionalis *NA*, eritque *NM*, parallela *BC*, altera asymptoton. Rursus sint proportionales *E A, $\frac{1}{2}AO, AI$* , & summâ *IT* equali *IN*, ducatur *TM* parallela *AZ*; eaque erit altera asymptotos. Denique sumtis *IX, IS*, quæ singulæ possint dimidium quadratum *AO*, unâ cum quadrato *AI*; erunt puncta *x* & *S* in hyperbola, aut sectionibus oppositis *D d*, ad inventas asymptotos describendis, quarum intersectiones cum circumferentia *DO*, ostendent puncta Reflexionis quæsita. Constructio hæc, in omni Casu, quo Problema Solidum est, locum habet, præterquam in uno, ubi non hyperbola sed parabola describenda est; cum nimirum circumferentia, per puncta *A, B, C* descripta, tangit rectam *AE*.

Hæc *Dn. Hugenius*, quorum cùm fecisset Editor copiam *Dn. Slusio* 24 Sept. 1670; hic d. 22. Novemb. ejusdem anni hoc modo respondit;

— Ut ad jucundissimas tuas respondeam, quas nuper admodum accepi, cùm variis de rebus agant, ab illa incipiam quæ mihi statim in oculos incurrit, ab *Alhazeni* nimirum Problemate, cujus constructionem à Viro Nobilissimo ad vos transmissam ut vidi, protinus eandem esse cum mea suspicatus sum; sed inspectis Adver-

sariis

sariis meis, non leve discrimen reperi, ut mox videbis, & jam sanè vidisses nisi me prolixitas ante hac à scribendo deterruisset. Nequid tamen dissimulem, cum Nobilissimi Hugonii constructionem ad calculos revocarem, eandem omnino mecum analysin secutum esse deprehendi; sed cum ex illa due nascantur effectiones, utraque per hyperbolam circa asymptotos; ille unam, ego alteram, uti facilio-
 Vid. Tab. II. rem, selegeram. Evidens est autem, nihil aliud quæri
 Fig II, III, IV. hoc Problemate (si illud ad terminos merè Geometri-
 cos revocemus) nisi in dato circulo, (cujus centrum A , radius AP) punctum aliquod ut P , à quo ductis ad puncta data E , B , inequaliter à centro A distantia, rectis PE , PB , recta AP producta bisecet angulum EPB . Quod quidem varios casus recipit. Vel enim normalis ex A in rectam EB , nimirum AO , cadit inter E & B ; vel ultra B . Si ultra, vel rectangulum EOB æquale est quadrato AO , vel majus vel minus. De casu æqualitatis videbimus infrà; nunc verò tres alios casus eadem ferè constructione complectemur. Per tria puncta A , E , B transeat circulus, ad cujus circumferentiam producat AO in D . Ac si quidem punctum O cadat inter E & B , recta AO versus O producenda erit; sin autem ultra B , sitque rectangulum EOB majus quadrato AO , producenda erit versus A ; at si rectangulum quadrato minus fuerit, circulus in ipso puncto D , rectam AO secabit. Tum ducta AX parallela EB , secante circumferentiam in N , fiat ut rectangulum DAO ad quadratum AN , ita $\frac{1}{2}$ AX ad AH , quæ sumenda erit versus X , si O cadat inter E & B , aut rectangulum EOB minus sit quadrato OA ; at ex parte contraria, si sit majus. Ponatur nunc OQ æqualis AH (in directum EB primo & secundo casu, tertio verò, versus E ;) Tum fiant proportionales XA , NA , HK , sumenda omni casu versus X : sectaque AO in V , ut sit eadem ratio KA ad AV , quæ AD ad AX ; jungatur KV , ac producat EM parallela OA , indefinite producta, in puncto L ; erunt omni casu KL & QL asymptoti Hyperbolæ, quæ per punctum O descripta, proposito satisfaciet: Hoc tantum discrimine, quòd primo & secundo Casu hyperbola per O , Problema solvet in speculo convexo, sectio verò ei opposita in concavo; at 3°. casu contrà, Hyperbola per O serviet concavo, ejus opposita convexo. Atque id quidem, cum punctum V cadit inter A & O ; nam si ultra O caderet, unica Hyperbola inter easdem QL , KL descripta, tam speculo convexo quàm concavo satisfaceret. Cæterum si V caderet in ipsum punctum O , Problema

tunc planum esset, & ipsæ rectæ LQ , LK illud absolverent. Unde patet, Problematis hujus dari casus infinitos, qui per locum planum solvi possunt: quo magis veniâ digni videntur ij, qui illud per eundem locum universè solvi posse censuerunt, quòd ipsis aliquoties calculus feliciter cecidisset. Nulla enim dari potest trium puncto- rum A, E, B positio, (de casu æqualitatis rectanguli EOB , & quadrati OA mox videbimus,) quæ non admittat circulum aliquem ex centro A describendum, ad cujus circumferentiam Problema per locum planum solvi queat. Hujus autem circuli radius, si tanti est, ita invenietur: In primo & secundo casu superioris constru- ctionis fiat ut quadratum AX unum cum duplo rectangulo OAD , ad duplum quadratum AD ; ita quadratum AO ad quadratum AN , erit AN radius quæsitus. At in 3^o casu, faciendum est, ut quadra- tum AX minus duplo rectangulo OAD , ad duplum quadratum AD ; ita quadratum AO ad quadratum AN .

Construendus nunc superest alius casus, æqualitatis nempe re- ctanguli EOB & quadrati AO , sive in quo circulus, per puncta A, B, E descriptus, tangit rectam AO . Rectè autem monuit Clarissimus Hugenius, hoc casu describendam esse Parabolam; quod tamen non ita intelligendum est, quasi per Hyperbolam solvi non pos- sit, cum & Hyperbolam & Ellipsin, imò infinitas (si quis metodo nostrâ uti velit) admittat; sed quod Parabolam quoque recipiat, quam alii casus respuunt. Eadem ratione temperandum est quod ait; Constructionem suam omni casu quo problema solidum est, lo- cum habere; intelligit enim, levi mutatione semper inveniri Hy- perbolam quæ proposito serviat: quod casus à nobis superius con- structos cum ejus constructione comparanti planum fiet. Ut autem ad casum æqualitatis redeam, & ne quid temerè asseruisse videar, Ecce tibi, non unam, sed duas parabolas, ac præterea Vid. Tab. II.
Fig. V. hyperbolas oppositas quæ propositum absolvunt. Sint, ut priùs, puncta data E, B , circulus ex centro A , ac alius per tria puncta A, E, B , cujus tangens sit AO , centrum D . Ductâ diametro $NADX$, fiant tres proportionales XA, NA, ZA , cujus dimidium sit AL . Fiant iterum tres proportionales $2OA, NA, IA$, cujus dimidium sit KA , & perficiatur rectangulum $LAOV$; productâ: que LV in S , donec VS sit tertia proportionalis ipsarum AL, OV ; axe SL , latere recto AL , vertice S , describatur parabola; hæc enim circulum secabit in punctis P, P quæsitis. Tantundem faciet alia, si perfecto rectangulo $DACH$, & productâ KC in T , ita

ut CT sit tertia proportionalis ipsarum AZ , DC , describatur circa axem TK , vertice T , latere recto, ZA : occurret enim circulo in *Vid. Tab. II.* iisdem punctis PP . Facilior adhuc est constructio per *Fig. VI.* sectiones oppositas; factis enim, ut prius, tribus proportionalibus XA , NA , ZA , demittatur ZI normalis, tertia proportionalis duplæ AO , & AN . Erit itaque ZI major ZA , cum dupla AO minor sit XA : Tum in puncto I , inclinentur utrinque angulo semirecto ad lineam IZ , rectæ IQ , IM , & ab utraque parte indefinitè producantur; demum circa illas tanquam asymptotos describatur per A hyperbola, & alia ipsi opposita; hæc enim satisfacet Problemati in speculo convexo, illa in concavo. Cum verò, ut ostendimus, ZI semper major sit rectâ ZA , recta IM nunquam transibit per A . Non dabitur itaque casus, quo ex hac constructione, velut in precedentibus, Problema per ipsas asymptotos solvi possit: Et tamen hoc quoque aliquando locum planum admittit; cum scilicet accidit, ut recta XO ducta ad centrum D tangat circulum NPP ; ipsum enim punctum contactus questionem solvit. Et hæc quidem de Problemate, quod hætenus multorum ingenia exercuit, & cujus solutionem ante aliquot annos absolvi, urgente *Clar. Gutis covio*, *Lovaniensi Matheseos Professore*, qui sibi usui futurum aiebat; moliebatur enim nescio quid in *Catoptricis*: Sed mors manum iniecit, neque enim, ut hoc obiter addam, quidquam hujusmodi in schedis ejus repertum esse intellexi.

Hætenus *Do. Slusius*; cujus Epistolæ Apographum cum, Authore conscio, Editor communicasset *Do. Hugenio*, simulque ex aliis laudati *Slusti* literis, 9 Martii 1671. datis, inuisset, invenisse ipsum duas alias ejusdem Problematis Analyses, priori illâ faciliores, & constructione inter se, & ab illa, diversas; quin imò præparationem quandam Generalem, ex qua Problematum omnium, quæ ad Punctum Reflexionis in Speculis Sphæricis, concavis & convexis, determinandum spectant, Analysis facile deduci possit: *Do. Hugenius* Gallicè rescripsit 7 Novem. 1671. (tardiùs, ob incommodam puto valetudinem,) in hanc sententiam;

Obstrictum me tibi fateor, eò quod *Slusianam* Problematis *Alhazen*i constructionem impertiri voluisti. Exurgit illa, ut rectè notavit, ex eadem *Analysi* cum mea, ab eaque non longe discrepat; videtur tamen, meam esse naturalem magis, idque ob *Hyperbolæ Asymptoton* dispositionem, nec tamen plus operæ requirit quam *Slusiana*.

Oportet

Oportet equidem, ut ipse hac de re cum eo agam, qui est Geometrarum, quos novi, omnium doctissimus candidissimusque; saltem ut copiam ab ipso petam facilioris adhuc illius Analyseos, quam invenisse se de hoc Problemate affirmat.

Sic Dn. Hugenius; qui cum aliis fortè negotiis, vel etiam adversâ valetudine impeditus, ipsi Dn. Slusio de hoc argumento scribere differret, Slusius verò dicti Hugenii mentem ab harum Editore accepisset, ipse (Slusius, inquam,) literas hîc subjunctas, Editori missas, reposuit.

Antequam ad literas tuas, 22^o mensis elapsi datas, respondeam, officii mei ratio postulat hoc Anni novi principio, ut faustum illum ac felicem cum longa similium serie, Tibi, Vir Clarissime, ac Societati Illustrissima & ὁλως βελ-
αιῆ, apprecer, quò ea quæ felicibus adeò auspiciis cepta sunt, porrò prosequi, ac tandem, magnæ Reip. literaria emolumento, ad exitum perducere Vobis i-
ceat. Literas verò tuas quod attinet, gratias habeo maximas pro iis, quæ me solitâ humanitate scire voluisti. Ceterum à Cl. Hugenio nihil adhuc acce-
pi, aliis, ut existimo, studiis occupato. Quoniam autem Tu, V. C. videri vis meas esse aliquid putare nugas, accipe, quæ circa Alhazeni Problema, curis secundis, meditatûs sum.

Datus sit Circulus, cujus centrum A; puncta data sunt D & d. Suppo-
natur factum quod queritur; sitque Radius incidens DE, re-
flexus Ed; & ex puncto reflexionis E cadat in junctam DA V.Tab. II.
normalis EI, & in eandem, ex d, normalis dN, occurrantque Fig. VII.
eidem Tangens EC & Radius dE, productus in B. Sit nunc DA=z.
AI=a. NA=n. EI=e. dN=b. BA=y. AE=q. CA=x.
Igitur, cum anguli, DEC, CEB, sint æquales, & angulus CEA
rectus, ex hypothesi; erunt tres, DA, CA, BA, harmonicè proportio-
nales, (hoc enim facile ostenditur.) Erit itaque ut DA ad BA, ita DC
ad CB; sive in terminis Analyticis, $z|y|z-x|x-y$; & $2zy-xy$
 $=zx$ sive $\frac{2zy}{z+y}=x$. Cum autem Rectangulum CAI, sive xa sit æquale
Quadrato AE sive qq, erit $x=\frac{aq}{a}$, & per consequens $\frac{2zy}{z+y}=\frac{aq}{a}$ sive
 $\frac{2qq}{2za-qq}=y$. Porro, est ut dN ad EI, ita NB ad IB; sive $b|e|y-n$
 $|y-a$. Itaque $ye-ne=by-ba$; & $y=\frac{ba-ne}{b-e}$. Igitur $\frac{2qq}{2za-qq}=\frac{ba-ne}{b-e}$
sive $2zb aa-2znae-qqba+qqne=bzqq-zqqe$. Quæ
æquatio est ad Hyperbolam circa asymptotos, cujus constructio cum Circulo dato,
Problemati satisfacit. Cùm verò, ob Circulum, sit $qq=aa+ee$, si loco
 $2bzaa$ ponatur ejus valor $2bzqq-2bzee$, habebitur alia pariter
ad Hyperbolam circa asymptotos, $bzqq-2bzee-2znae-qqba$
 $+qqne=-zqqe$. Et hac methodo, atque illâ, quam in libello nostro de
Analyfi exposuimus, prodibant infinitæ Equationes ad Hyperbolas & El-
lipses, quæ cum Circulo dato Problema absolvent; nisi quod Effectiones plæ-
rumque intricatiores evadant quàm ut operæ pretium sit illas aggredi: Con-
strui tamen poterunt eo modo, quo usi sumus in Ellipsi, ejusdem libelli nostri
p. 62.

Retulimus, ut vides, calculi nostri summam ad lineam DA ; sed satis animadvertis, non majori difficultate referri potuisse ad dA . Vid. eandem Fig. VII. (quæ pariter data est,) ductis scil. lineis, quas in Schemate punctis adumbravimus. Verum novo calculi labore non est opus. Si enim rectæ dA , ejusque partibus, eosdem ac prius terminos analyticos adhibeas, b. e. si ipsam dA facias æqualem z , $Dn = b$. $nA = n$. $AI = a$. $iE = e$, &c; prodibit eadem Aequatio quæ prius; & infinitas alias Hyperbolas & Ellipses obtinebis, quæ cum Circulo dato Problemati satisficient. Postindè essem, si singulos casus prosequi vellem, cum illorum Aequationes solâ signorum $+$ & $-$ variatione discernantur. Unum tamen excipio, nim. cum angulus dAD est rectus; ejus enim æquatio habetur, expunctis à priori æquatione partibus, in quibus n (quæ in nihilum abit) invenitur: nempe hæc, $2zbaa \cdot qqba = bzqq - zqqe$, vel (pro $2zbaa$ posito ejus valore) $zbqq - qqba = 2zbee - zqqe$.

Sed animadvertendum est, quòd, licet referendo Analysis ad rectam DA , statim sese offerant in æquatione duæ Hyperbolæ; & alia totidem à prioribus diversa, cum refertur ad rectam dA ; easdem tamen omninò Parabolas haberi, ad utramvis rectarum dA vel DA referatur Analysis: cujus rei ratio levi consideratione Tibi occurret.

Patere nunc, V. Cl. ut superiorem Analysis omnibus, quæ circa Speculorum Sphericorum reflexionem proponi solent, Problematibus applicem, novo facto Schemate. Sit igitur, ut prius, Circulus, V. Tab. II. Fig. VIII. cujus centrum A , punctum D datum, & ab eo radius incidens DE , cujus reflexus sit EQ . Iunctâ DA , ducatur ad illam Tangens EC , & normalis EI ; & producatur ad eandem, recta QEB ; denominentur partes ut prius. $DA = z$. $CA = x$. $AE = q$. $BA = y$. $AI = a$. $IE = e$. Igitur, propter tres DA , CA , BA , Harmonicè proportionales, & tres CA , AE , AI , Geometricè, semper habebitur æquatio $y = \frac{zqq}{2za - qq}$, in quodcunque Circuli punctum cadat DE . Itaque, si quæraturn punctum E , in quod si radius DE incidat, reflectatur parallelus diametro $LA V$ normali ad DA ; reflexus QE , productus transibit per I , ut patet; & I ac B coincident. Igitur $a = y = \frac{zqq}{2za - qq}$; sive, $aa - \frac{1}{2} \frac{qqa}{z} = \frac{1}{2} qq$, & Problema per plana solvetur.

Si quæraturn punctum, à quo radius reflectatur parallelus alteri cuilibet lineæ, ut AK (ductæ ex centro A ;) ducatur ad illam, ex puncto I , Tangens $KL = d$. Evidens est, Triangula AKL , EIB , fore similia, cum omnia latera unius parallela sint lateribus alterius. Itaque AL ad LK ut EI ad IB , sive $q|d|e|a - y$; & $\frac{qa - qe}{q} = y = \frac{zqq}{2za - qq}$; & $zq^3 = 2qzaa - 2zdae - q^3a + qqde$; sive, pro aa posito $qq - ee$, $zq^3 = 2zq^3 - 2zqee - 2zdae - q^3a + qqde$. Utraque autem æquatio est ad Hyperbolam circa asymptotos, quæ cum Circulo dato Problema absolvit.

Proponatur nunc efficere, ut radius reflexus transeat per datum punctum N (ut in Problemate Alhazeni,) vel ut productus versus punctum reflexionis E occurrat dato puncto N . Ex N cadat in AL normalis $NO = n$, sitque $AO = b$. Patet esse, ut AO ad differentiam ipsarum ON, AB , ita EI ad IB , h. e. $b | n - y | e | a - y$; vel $b | y - n | e | a - y$. Igitur $\frac{ba - ne}{b - e} = y = \frac{zqq}{2za - qq}$. Unde $2zbaa - 2znae - qqba + qqne = bzqq - zqqe$; nim. illa ipsa equatio Problematis Alhazeniani quam supra innuimus: Vel, secundo casu, $\frac{ba + ne}{b + e} = y = \frac{zqq}{2za - qq}$, sive $2zbaa + 2znae - qqba - qqne = zbqq + zqqe$. De quibus equationibus plura non addo, cum vel nimia sint fortasse quæ supra diximus.

Atque hæc sunt Problemata, quæ circa Punctum reflexionis proponi solent in quibus tamen finitam puncti D dati distantiam supposuimus. Sed facilius erit Analysis, si supponamus Infinitam. Secta enim CA bifariam in G , constat ex proprietate trium, DA, CA, BA , Harmonicè proportionalium, tres DG, CG, BG , fore Geometricè proportionales, suppositâ quâcunque puncti D distantia. Itaque, si supponatur Infinita, BG abibit in nihilum, & punctum B cum puncto G coincidit. Igitur AB erit perpetuò equalis BC ; erit itaque $CA = 2y$, & Rectangulum CAI , equale Quadrato AE , dabit, in terminis Analyticis, $2ay = qq$, sive $y = \frac{qq}{2a}$: Cumque distantia puncti D supponatur infinita, erit ED parallela AC . Itaque, si queratur radius reflexus parallelus AL , quoniam eo casu a & y coincidunt, erit $a = y = \frac{qq}{2a}$, sive $aa = \frac{1}{2}qq$: Si queratur ut parallelus sit AK , erit rursus $q | d | e | a - y$; & $\frac{qa - de}{-q} = y = \frac{qq}{2a}$, sive $2qa - 2dae = q^3$. Si petatur ut transeat per N , erit, ut supra, $\frac{ba + ne}{b + e} = y = \frac{qq}{2a}$, & $2baa + 2nae = bq + qqe$: quæ equationes sunt quoque ad Hyperbolas circa Asymptotos, nisi N punctum esse supponatur in AL ; nam, cum tunc n abeat in nihilum, sublatis ab equatione partibus, in quibus n continetur, residue dant equationem ad Parabolam, ut supra quoque monuimus.

Non expectas, V. Cl. ut cum specula Concava hætenus in exemplum adduxerim, nunc agam de Convexis. Scis enim, eandem esse prorsus Analysis, & Equationes solâ signorum + & — variatione distingui. Scis, Parabolam vel Ellipsin, quæ uni satisfacit, satisfacere alteri; & si Hyperbola in Convexo problema absolvat, ejus oppositam paria facere in Concavo. His itaque omissis, addo tantum, eâdem Analysis haberi in Speculis Concavis focos & spatia, quæ radii occupant in axe, datâ qualibet puncti lucentis distantia: Sed mirâ facilitate, cum radii supponuntur paralleli; quod tamen nonnullis circuitu à quibusdam demonstrari vidi. Nam in Speculo Concavo EE , cujus centrum A , si radius extremus reflecti intelligatur ad axem AR in B , ductâ tangente EC , erit $CB = BA$. Bisecetur semi-axe

AR in Q; erit itaque Q focus. & QB spatium quæsitum. Est autem QB dimidia CR (ob æquales AQ, QR, AB, BC,) h. e. dimidia excessus secantis arcus ER supra sinum totum. Igitur si arcus ER sit (e. g.) grad. 9, erit AC 101246, & BQ $\frac{623}{10000}$ ipsius AR.

Sed nimium Te moror in tricis hisce Geometricis, quibus me defunctum existimabam, nisi quod occurrant sæpe vel aliud agenti. Itaque si Deus vitam & otium dederit, hoc vere fortassis in publicum emittam mea, de Problematum determinatione, περί νομαχοῦ λόγου, de Tangentibus Curvarum, μελετήματα; præsertim cum Cl. Riccius me moneat, à se, studiis aliis occupato, nihil expectandum esse; & nuper ἀπεγορευμένης inciderim in methodum facillimam ea demonstrandi, quæ longiore circuitu olim inveneram; utrâque tamen viâ in brevissimam ac facillimam Regulam desinente. Sed quid futurum sit, Θεῶν ἐν γένοισι κείται: Ego enim Pyrrhoniano more hætenus ἰδὲν ὀπίσσω.*

*Quid hic de Tangentibus Curvarum pollicetur Vir Illustrissimus, præstita ab eo vide in Transact. N^o. 95.

Vale, Vir Cl. meque ex asse tuum, ut Soles, amare perge. Dab. Leodii VI. Kalend. Januar. st. n. CIOIOCLXXII.

Hæc Dn. Slusius; quæ quomodo placuerint Dn. Hugenio, quidque hic iis rescripserit, aliâ occasione, cum unâ vice omnia huc spectantia tradi commodé nequeant, Deo dante, exhibebimus.

An Account of four Books.

- I. *Tracts, consisting of Observations about the SALTNESS of the SEA: An Account of a Statical HYGROSCOPE and its Uses; together with an Appendix about the FORCE of the AIR'S MOISTURE: And a Fragment about the NATURAL and PRETERNATURAL STATE of BODIES: By the Honorable R. Boyle. To all which is premised, A Sceptical Dialogue about the POSITIVE or PRIVATIVE NATURE of COLD: By a Member of the R. Society. London, 1673. in 8^o.*

THe Dialogue about *Cold* presenting is self first in the Body of this Book, though it be named last in the Title-page, we shall first of all take notice of the same in the Account we intend to give of these Tracts.

One of these Dialogists therefore having taken occasion from Mr. Boyle's History of Cold to express his wonder, that that Noble and Intelligent Author had in that History omitted to tell the Learned world, whether he asserts *Cold* to be a *Positive* quality, or a bare *Privation* of Heat; and another of them having conjectur'd the principal reason of that silence to be that Author's unwillingness to deliver in abstruse subjects a positive opinion before a compleat History of the *Phænomena* be deliver'd; it being much safer to reserve that for the latter end, when the Nature of the thing inquired into may of it self result from the Considerations, suggested by the precedent matters of fact surveyed and compared together: These two, *I say*, having thus made an Introduction to this Discourse, the Author of it maketh it his business to examine all the weighty Arguments, alledged by *Gassendus*, seeming strongly to maintain the *Positive* nature of Cold; but yet in strict ratiocination found to be not cogent. Where the Author, among other particulars, shews, that those Bodies must be Cold as to sense, whose parts are less agitated than those of our Hands, and consequently Metals, Stone, Wood, and other Solid bodies, as also all unmingled Liquors we know, being heated by the fire, will grow cold again of themselves, because the adventitious motion ceasing by degrees, either upon the
recess

recess of the igneous corpuscles, or the imparting of the extraneous agitation to the Air or other contiguous bodies, the Stone or Water, &c. will again have so much fainter an agitation, than that of a man's Sensory, as to be by him judged Cold. And if this already impaired agitation be still more and more lessen'd, the Body will still grow colder and colder without the help of any *Positive* cause; till at length the agil parts, that kept it warm or fluid, being quite expelled or disabled, the form of the liquor, *for example*, comes to be exchanged for that of Ice.

Several considerable Experiments of Mr. Boyle's being in this Discourse occasionally refer'd to, one of the Interlocutors mentions not only the particular scruples, but also divers *phenomena* of Experiments, that kept the same Gentleman from declaring himself about the Nature and Cause of Cold.

To this Dialogue are annexed three small pieces by Mr. Boyle;

The *first* contains two *Problems* about Cold, grounded on New Experiments; whereof one is, *How upon the mixture of two or three Bodies there should manifestly ensue a great and tumultuary agitation of small parts, and yet even during this conflict, not any sensible Heat, but a considerable degree of Cold be produced, and that even in the Internal parts of the mixture?* The other is, *Whence the vast force of freezing water proceeds?*

The *second*, delivers an Attempt to *manifest and measure* the great Expansive force of Freezing water, by three Experiments.

The *third*, recites a New Experiment about the Production of Cold by the Conflict of bodies appearing to make an Ebullition.

From these Particulars this Book proceeds to another *Tract*, containing *Observations and Experiments* about the *Saltiness of the Sea*.

In it the Author, not being satisfied with the opinion of the *Peripateticks*, who derive the Saltiness of the Sea from the Adustion of the water by the Sun-beams, and having answered the arguments alledged for that opinion (where, upon occasion, many considerable Observations and Experiments do occur,) delivers us his own sentiments about the Cause of that *Phenomenon*, therein agreeing with the famous *Gassend* and some other Modern Writers, *viz.* That the Sea derives its saltiness from

from the Salt that is dissolved in it; which Saltness he takes to be supplied not only from Rocks and other Masses of Salt found either at the bottom or at the sides of the Sea, but also from Subterranean Steams and from the Salt, which the rains, rivers and other waters dissolve in their passage through divers parts of the Earth, and so carry along with them into the Sea. Here he takes occasion to speak of his attempt of distilling sweet water from Sea-water; which done, he *first* removes some Objections; *next*, considers of the Cause of the bitterness Joined to the Saltness of the Sea-water; *then*, takes notice not only of the differing Colors and other Qualities of the differing parts of the Sea, arguing, that 'tis not every where of an Uniform substance; but also of the Sea-waters capableness of Purefaction: To all which he subjoins divers Observations about the various *Degrees* of the Saltness of the Sea, and what himself observed and tried concerning the Saltness of our Sea and the *Gravity* of the Sea-water between *England* and *France*; concluding this whole Discourse with two suspicions; the *one*, that, at least, in many places, the Saltness of the Sea may continually, though but slowly, increase not only by the accession of that Saline matter, that is imported by Salt-springs, and that which Rivers and Land floods do rob the Earth of; but also by the Saline steams plentifully ascending into the Sea from Subterranean Fires: the *other*, that Sea-water may be render'd much more salt to the taste by volatil Salts, and yet be very little heavier.

Upon this argument follows a *Section*, that should have been subjoined to the *Relations about the Bottom of the Sea*, formerly printed, but was not then seasonably deliver'd to the Printer; And therein is contained an Inquiry about the Vegetation and Growth of Plants in sub-marine Regions; where occur some Observations, made chiefly of that Stony plant, *Corall*, as also a sort of Laurel-trees growing about *Manar* at the bottom of the Sea, and the famous *Maldivia* Nut, born by a sort of Cocco-trees that grow so likewise, and are thence either torn off by the agitation of the water, or gather'd by the *Divers*.

After this follows a *Paradox of the Natural and Preternatural State of Bodies, especially of the Air*. Wherein the Author teaches, that as a Body, whatever state it be put into or kept in, obtain-
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ing or retaining that state according to the Catholick Laws of Nature, cannot be denied to be in a *natural* state; so upon the same ground 'twill be hard to deny, but that those Bodies, which are said to be in a *violent* state, may also be in a *natural* one, since the violence they are presum'd to suffer from outward Agents, is likewise exercised no otherwise than according to the establish'd Laws of Universal Nature. This the Author exemplifies, and particularly applies to the state of the Air.

As to his Discourse of a *Statical Hygroscope*, and the Uses of such Instruments, he pitches upon a fine *Sponge*, as that which is easily portable, and not easie to be divided or dissipated, and which by its readiness to soak in water, to him seem'd likely to imbibe the aqueous particles dispers'd in the Air; which also, by its porousness throughout hath much more *superficies* in reference to its bulk, than any body not otherwise less fit for the intended use that came into his thoughts. It seems, our Author tryed divers other Bodies, as several Salts, Lute-strings, Cups turn'd out of light wood, white Sheeps-leather; but found none so convenient for his purpose, as a Sponge, which how he turn'd into a *Hygroscope*, is largely explained in this Discourse: To which are annex'd the various Utilities of Hygroscopes; as 1. To know the differing Variations of weather in the same month, day and hour. 2. To know how much one year and season is dryer or moister than another. 3. To discover and compare the changes of the Temperature of the Air, made by Winds, strong or weak; frosty, snowy, and other weather. 4. To compare the temperature of differing Houses, and differing Rooms in the same House. 5. To observe in a chamber the Effects of the presence or absence of a Fire in a chimney or stove. 6. To keep a chamber at the same degree, or at the assign'd degree of driness.

To this is subjoined a *New Experiment* and other instances of the *Efficacy of the Air's Moisture*, not only upon Men's Healths, but upon subjects far less tender, and less curiously contrived, than Humane bodies, as Wood, Strings of Musical Instruments, Metallin pipes, Vitriolat Marcasites, and Ropes; of which last the Author makes use for an Experiment to shew, not only in general, that the Moisture of the Air may have a considerable Efficacy, but to assist us to make some estimate in *known measures* of the mechanical force of the Aerial moisture.

II. *Principia & Problemata aliquot Geometrica, antè desperata, nunc breviter explicata & demonstrata; Auth. T. H. Malmesburienſi. Londini A. 1673. in 4^o.*

THe famous Author of this Tract having entertained the Reader with ſome Generals, concerning the Subject, Principles and Method of Mathematicks, and with his Doctrine of *Ratio*, as alſo his ſenſe of Algebraical operations, together with two Chapters of Quadrate Figures, Quadrate Numbers, and Angles; undertakes to confirm his former Doctrine; 1. Of the *Ratio* of the Circumference to the *Radius* of a Circle; 2. Of Mean Proportionals; 3. Of the *Ratio* of a Quadrat to the Quadrant of a Circle inſcribed in it; 4. Of Solids and their Superfices: To which laſt he ſubjoins another Method of demonſtrating Solids and their Superfices by their Efficient cauſes. Which done, he concludes the Book with a Diſcourſe touching Demonſtrations; the principal and moſt frequent cauſe of Fallacies in the Mathematicks; and the Notion of the word *Infinite*: Complaining very much, that Geometry hath received its greateſt prejudice from thoſe, that diſcourſe of a Line without Latitude; that take the ſide of a Square for the Root of a Number; that underſtand not the true nature of *Ratio*; and that ſpeak unfavourly of *Infinity*. Which accusations how well they are grounded, we muſt leave to competent judges to determine.

III. *An Idea of a Phytological Hiſtory propounded; together with a Continuation of the Anatomy of Vegetables, particularly proſecuted upon Roots; and an Account of the Vegetation of Roots grounded chiefly thereupon. By Nehemiah Grew M. D. and Fellow of the R. Society. London, 1673. in 8^o.*

THis Learned and Inquiſitive Author, after the publication of his firſt endeavors about the Anatomy of Plants, (of which an Account was given in Numb. 78 of theſe Tracts,) being reſolved upon a further proſecution of them, hath given us the *Series* of his Thoughts and Obſervations following thereupon in this his Second Book, diſtributed in three Parts.

The *firſt* contains the Author's *Idea* or Deſign of a Phytological Hiſtory, tending to the improvement of the knowledge of Vegetables: In order whereunto, five general Means are by him propounded. The *firſt* is a particular and comparative Survey of whatever is of more *External* conſideration about

Vegetables, as of their Figures, Proportions, Seasons, Places, Motions. The *second*, a like Survey of the *Organical* parts by *Anatomy*, and how that is to be prosecuted both without and with a Microscope; together with the particulars to be observed, and what from observation made is probably attainable, *viz.* That from thence we may come to know, what the Communities of Vegetables are, as belonging to *all*; what their Distinctions to such a *kind*; their Properties, to such a *species*; and their Particularities, to such *particular ones*. The *third*, such another Survey of the *Contents* of Vegetables; of their several kinds, as Spirits, Airs and Vapors, clear Saps, Milks, Oyls, Gums, Sugars, Salts, &c. Of all which he would have observ'd their Receptacles, Motions, Qualities, Consistence, Colors, Smells, Tastes and Faculties chiefly residing in such or such a Plant above others. All these to be further examined by Contusion, Agitation, Frigefaction, Infusion, Digestion, Decoction, Distillation, Arefaction, Afflation, Ustion, Calcination, and by Composition with other bodies, and by Compounding the Experiment it self. A comparative prospect of all which wayes of Observation being taken, by it at last the Communities and Differences of the Contents of Vegetables may be discern'd; the manner of their Causation and Original partly be judged of; and wherein it is that the Essence of their several Natures and Qualities consists, in some measure comprehended: And consequently both from the knowledge of their particular Natures, and the Analogy found betwixt them, we may be enabled better to conjecture and try, what any of them are or may be good for. The *fourth* means, a like Survey of the *Principles* as well as the Contents of the *Organical* parts: Whence will be attainable a further knowledge of the Modes of Vegetation, and of the Sensible Natures of Vegetables, as also of their more recluse Faculties and Powers. The *fifth*, a like Survey of those Bodies, either *from which* these Principles are derived, or *wherewith* they have any communion, which are *Earth*, and all solid receptacles; *Water*, and all liquid receptacles; *Air*, and *Sun*. All which our Author concludes with putting the Question once more, *viz.* In what manner these *Principles* are so adapted as to become capable of being assembled together in such a Number, Conjugation, Proportion and Union, as to make a Vegetable body? For the comprehension whereof *he saith*, we must also know, What are the

Principles of these Principles : which though they may lye in a great abyss of obscurity, yet they are not by him judged to be altogether undiscoverable.

So far the *first* part of this Book. The *Second*, being a Continuation of the Anatomy of Vegetables, particularly prosecuted upon *Roots*, and premising something considerable as to their Figures, Motions (where he notes the motion of Descent to belong to very many other kinds besides the Bulbous) and Ages; it proceeds to the several Parts of a Root; as 1. the *Skin*, its external Accidents and Original, its Compounding parts, the one Parenchymous, consisting of bubbles, the other Lignous, consisting of Tubulary vessels. 2. The *Bark*; its Original, and external Accidents, its Compounding parts, likewise Parenchymous, and Lignous; which latter consists of Succiferous vessels, conjugated into Threds, but no where inosculated, nor ramified, but distinct as the fibres of a Nerve, which vessels are of various kinds, denominated from their contents, as Lymphæducts, Lacteals, &c. 3. That portion of the Root within the Bark, of the like composition with the former, and its Lignous part compounded of Succiferous and Air-Vessels: Where the structure of the Bark, and, more visibly, of this portion of the Root, is compared with that of a *Muscle*; and the Air-vessels with *Nerves*: Concerning which latter vessels he observes with the Excellent *Malpighi* (who, about two years since, presented the *Royal Society* with his Manuscript upon the same subject, the *Anatome of Plants*) the *Spiral* position of their parts; adding to that Observation, that that *Spiral Zone*, as Signor *Malpighi* calls it, is not one absolutely entire piece, but consists of two or more round and perfect Fibres standing collaterally together. 4. The *Pith* not common to all Roots; its Original, parenchymous Nature and Texture, like to a *Rete mirabile* or an infinit number of small fibres admirably complicated together; its contents being sometimes a limpid Liquor, sometimes a vaporous Air. And so much of the *Second* part.

The *third* contains an Account of the *Vegetation* of *Roots*, grounded chiefly upon the foregoing Anatomy. Where our Author having soberly weighed, that all true Philosophy necessarily asserts a God, and secures our Veneration of Him, and of his Providence, and Laws, considers *Nature* as one Universal Monarchy, visible, as in all other particular Oeconomies, so no less in that of *Vegetables*, if we take notice, That the Soil is prepar'd by

Rain, Sun, Wind, Air, and their several successions; *that* the parenchyma of the Bark of the Root, standing in the Soil thus prepared, receives the watry parts of the Soil; *that* the Skin strains the water and renders it more pure; *that* the sap thus strain'd, yet being compounded of heterogeneous parts, and they received into the said parenchyma, they will now ferment; whereby being yet further prepar'd, they will more easily insinuate themselves into all the Bubbles of that parenchyma, which being in no place openly and visibly pervious, but every where compos'd of an infinit number of small *bubbles*, the Sap therefore is not only fermented therein, and fitted for separation, but, as it passes through it, is every part of it *strain'd* an hundred times over from *bubble* to *bubble*. But then how the Sap thus *fermented* and *strained* is further distributed to the *Organical* parts, receives a tincture from the Fibres, passes on to the Succiferous and Air-vessels, nourishes them, is transmitted into the Pith, and there yet more kindly digested; in a word, How the whole progress of Vegetation is performed, is amply explain'd by our Author, and would take up too much room here to particularise. The Discerning and Candid Reader will find in the perusal of the Book it self abundance of Instruction in that matter; besides the explication of a great variety of *phenomena*, occurring in the contemplation of Vegetables; as, Why the Organical Parts are void of Taste, Smell and Colour. Whence the Succiferous Vessels are tough, and the Parenchymous parts friable? How the said succiferous Vessels grow in length, cylindrical, and hollow; the Lactiferous, how and why wider? How the Air-vessels are form'd? How the Parenchymous parts become fibrous, and the Fibres disposed into Bubbles? How all stitched up together? Whence the situation of the Air- and Succiferous vessels; whence the Motion of the Air-vessels towards the circumference of the Root; and whence many of the succiferous left behind the Air-vessels in the Pith? How Roots come to be variously sized and shaped? How the Pith made as the Root thickens? Whence the Root long, whence ramified, whence Cylindrical or Pyramidal? How Roots are variously moved, as in a level, or perpendicularly? How they grow deep or shallow? How variously aged? Whence the Contents of Vegetables are various? The Content of the Parenchymous fibres, the Pith, the Lymphæducts, the Lactiferous and the Aerial Vessels? The Content of a Vine, of Corn, &c. Whence so little oleous, of others more, &c.

All which is concluded with excellent Observations of the Odors of Vegetables, of their Colors and Tasts : And the whole piece illustrated with seaven *Tables* of *Cutts*, representing the *Figures* of several Roots, as the Author had view'd them both with the naked Eye and the Microscope ; together with an Explication of these Figures.

IV. Thomæ Bartholini *ACTA MEDICA & PHILOSOPHICA* Ann. 1671, & 1672. Hafniæ, 1673. in 4^o.

IN this curious Book are contained 139 Observations, amongst which we shall here take notice of these following ;

1. The opening of Arteries, used in Eye-pains, Cataracts of Eyes, and divers other cases, with good success.

2. The Anatome of a Horse of his Majesty of *Denmark*, the mouth of which, being yet alive, was suddenly grown so stiff and so closed, that it could not feed, and so pined away and died. Upon the death whereof, immediately the muscles of the neck and shoulders, that were tense and hard whilst the horse lived, became flaccid : In whose stomach, and between whose Guts and *Peritoneum*, were found abundance of small white and black worms, some living and some dead : Besides, its *Heart* was of an unusual bigness, and very hard on the left side, with a great *polypus* in the ventricles thereof ; and the *Lungs* very small, hard, discolour'd, immoveable even by an immitted syringe. More-over it had between the Muscles of the *abdomen*, and those of the neck, on both sides of the *aspera arteria*, store of an unusual water. Whence it was concluded by the Learned Dr. *Simon Pauli*, that the corrupted blood of this Horse and the extravasated *lymphæ*, having vellicated the Muscles, and withall the too streight bridles, used on this horse, having compressed the glanduls about his neck, and perhaps the horses sweat having been too suddenly suppressed, this *tetanus* or stiffness had been occasioned.

3. The Cure of the Dropsie and the Stone in the Kidneys by Bier brew'd of Oaten malt, and fermented with Birch-water and *Daucus*-seeds.

4. The Cure of the Dropsie by decoctions of the flesh of Hedge-hoggs, frequently tryed with very good success.

5. The Rarities in the Isles of *Fero* near Scotland ; among which is related, the living and feeding of whole flocks of sheep under the Snow ; the so exceeding abundance of Grass there, that it fattens Oxen to that degree as to make them yield an 100 pound
of

of tallow; and the art of driving away and sinking Whales by *Castoreum*, kept between the outermost boards of the fore-deck or other convenient parts of a Ship.

6. Divers Observations and Experiments made upon *Amberias*, that a whole *Cricket* hath been found swimming in it; that two *Gnats* have been seen in it in coitu; that Amber will not be softened when put into boiling wax, nor well dissolved in Oyl of Spike, or Turpentine, or Rock-oyl; but will in Oyl of Lavender, and other distilled oyles, as also in rectified Spirit of wine; which mixture, he saith, yields an excellent medicine. On which occasion this pretty Experiment is added, viz. That *Rock-oyl* being kept in an Alembic for three weeks, and at the end of them the Oyl by a stronger fire totally extracted, the remaining hardened and solid body will emulate Amber in brightness and the attractiveness of straw, &c; though it be much more brittle than genuin Amber.

7. An *Alga* or Sea-weed growing on the *Iseland* shore, that yields a kind of Sugar, extracted by the heat of the Sun, and used by the *Islanders* instead of Sugar.

8. A *viscus*, growing copiously on Almond-trees in the mountains of *Provence*.

9. A new kind of *Acetum*, with ease and speed and before any previous fermentation to be drawn out of the flowers of the herb *Gallium*, serving like runnet for coagulating milk; which will not succeed by distilling *Sorrel*, &c.

10. A way of melting *Regulus* of Antimony without fire by mixing it with *Sublimat*, thus; *R. Reguli Antimonii optimi ℥jv, easq; in mortario vitreo marmoreo ve in tenuissimum redige pollinem, quod in charta munda sepone. In eodem mortario sed prius expurgato, Mercurii sublim. ℥xij itidem comminue in pulvisculum subtilissimum; tandem pollinem utrumque in charta, bacilli querni vel fagini agitatione crebra probe commixtionis ergo, conjunge. Tum pulveres hos ita permistos vitro quadrato minuscule, vulgari quidem, sed strictioris orificii immitte, immissoq; bacilli frigidi extremitate latiori valide & continuo comprime, ita ut superficies pulveris ubiq; pressa in arctum cogatur. Insiste premendo per semihoram, & videbis bacillum tuum mox alce subire massam, eoq; facto vitrum incallescere, & materiam vitro contentam extra oras ejus se evolvere, spumare, effervesce-
re, fundi, & totum cubiculum gravi vapore confundere.*

11. A way of making two Spirits, both cold to the touch, to flame when mingled together, thus; *R. Spiritus terebinthinae Ve-*

meta recens proleſti, ad frigus tamen nativum reduſti, uncias 4; quibus in ampliori vitro affunde Aquæ fortis generoſe itidem recentis, ſed & frigide, uncias 6; & agitando vas, ſub dio relinque, & intra horæ mediæ ſpatium, remoto operculo, ſpiritus Terebinthinæ, ab acidis Aquæ fortis particulis irritatus, efferveſcere incipiet, flammâmq; conſpicuam emittet. Quod tamen incuſſum tentatur, niſi in ſpiritibus recentibus.

12. A contrivance of making water not boyl in the miſt of boyling water, by hanging a narrow-mouth'd glaſs, half full of water, in the miſt of an Iron kettle filled with water, whereupon the ambient water may by a ſtrong fire be made to boyl, when as the water in the glaſs, though it be hot, yet will not boyl at all, though ſome few bubbles be ſeen at the bottom, which do all vaniſh, before they come to the top.

13. That water frozen receives nothing extraneous into it ſelf, in regard it increaſes not in weight, as it neither decreaſeth therein: And that glaſſes with water do not break when frozen in the open Air, whereas they do when frozen within doors.

4. A way of diſſolving Silver and Mercury into a liquor by a vegetable Sulphur, that is, by mixing 8 ounces of good *Aqua fortis*, and 2 ounces of Camphir beaten ſmall, and by putting them in a glaſs-vial upon warm ſand, carefully decanting after half an hours time the diſſolved oyl of Camphire from the *Aqua fortis*, and powring an ounce of it upon two drachmes of fine and thinly beaten ſilver, boyling it together for a quarter of an hour by a mild heat of aſhes; whereupon the Silver will plainly diſſolve into a liquor. The ſame will hold with *Mercury*, taking the ſame quantity of it and the Camphir-oyl.

15. An un-common way of diſſolving Gold, without adding common Salt or Sal Armoniac to the *Aqua fortis*, only by a double deſtillation of *Aqua fortis* from an equal quantity of Niter; by which preparation the *Aqua fortis* will not any more diſſolve Silver, but precipitates it into a powder, though then it convert Gold into a yellow liquor.

16. That even in well-purged *Mercury* there is harbour'd an Acid. Which was diſcover'd by putting ſome very pure copper-plates into a new long glaſs, wherein was kept very well purged Mercury, and by keeping them there three months, without any other heat but that of the Sun. Whereupon the glaſs, which had been kept very cloſe, being open'd, all the ſaid plates appear'd to be cover'd with ruſt, though in the miſt of ſo noble a liquor.

17. The

17. The Anatome of an Hedge-hog, in which was found a Muscle of a circular form embracing the *panniculus carnosus*, and reaching to the feet, tail and head of the animal, and thereby assisting it for a circular contraction at its pleasure.

18. Of the Womb of a Hare dissolving her own foetus; which our Author from Mons. *Steno* adscribes to a *menstruum* furnish'd by nature, and fit to prevent putrefaction. Whence some hope is rais'd for such women as retain dead children, if from other causes they abound not with putrid humors.

29. Of a poor Parisian Woman, which having for three years together taken no other food but *Spirit of Wine*, was thence burnt to ashes, when on a certain evening she sat down & fell asleep in a chair of straw.

20. That at *Copenhagen*, the Magnetick Needle did then vary 3 deg. 35 min. Westward; and that with the same Needle the variation at *Huenna*, being but 3 miles from *Copenhagen*, was found to be 2 deg. and 35 min. These observations were made by Dr. *Erasmus Bartholin* and Monlieur *Picard*, two able and accurate observers.

21. That by reason of the suspicion, which some considerable men entertain of the Variation of the *Meridian*, they have made in a convenient place at *Copenhagen* an accurate Meridian, for future observation and comparison.

22. That the *Norwegians* make use with great success of *Tarr* of Fir-trees in Malignant Feavers, by drinking it in their bier: And that they employ the powder and moss of that Wood in very dangerous wounds; as also that *Pitch* is a present remedy for the Gout.

23. That an excessive fatness in a man of above 60 years of age was cured by Pills made of *Mercurius dulcis*, causing a great salivation: Where the Author notes from Dr. *Borrichius*, that, though it hath been already known, that a noysom *pituita* is discharged by the Salival glands, yet 'tis new, that the cause of too much fatness is carried off by the same way.

25. That a live Hedge hog being shut up in a great pipkin, and a flame made about it, the animal for a long while gave not any sign of pain; only it had contracted it self into the shape of a very round ball, shooting out his bristles round about, as if he would make them fight against the violence of the fire: which lasted a great while to the amazement of the by standers, who took notice, that at length, all about him being red hot, and the flame striking upon his *panniculus carnosus*, and the bristles falling off together with it, the poor creature died with no other revenge than a slight grunting noise.

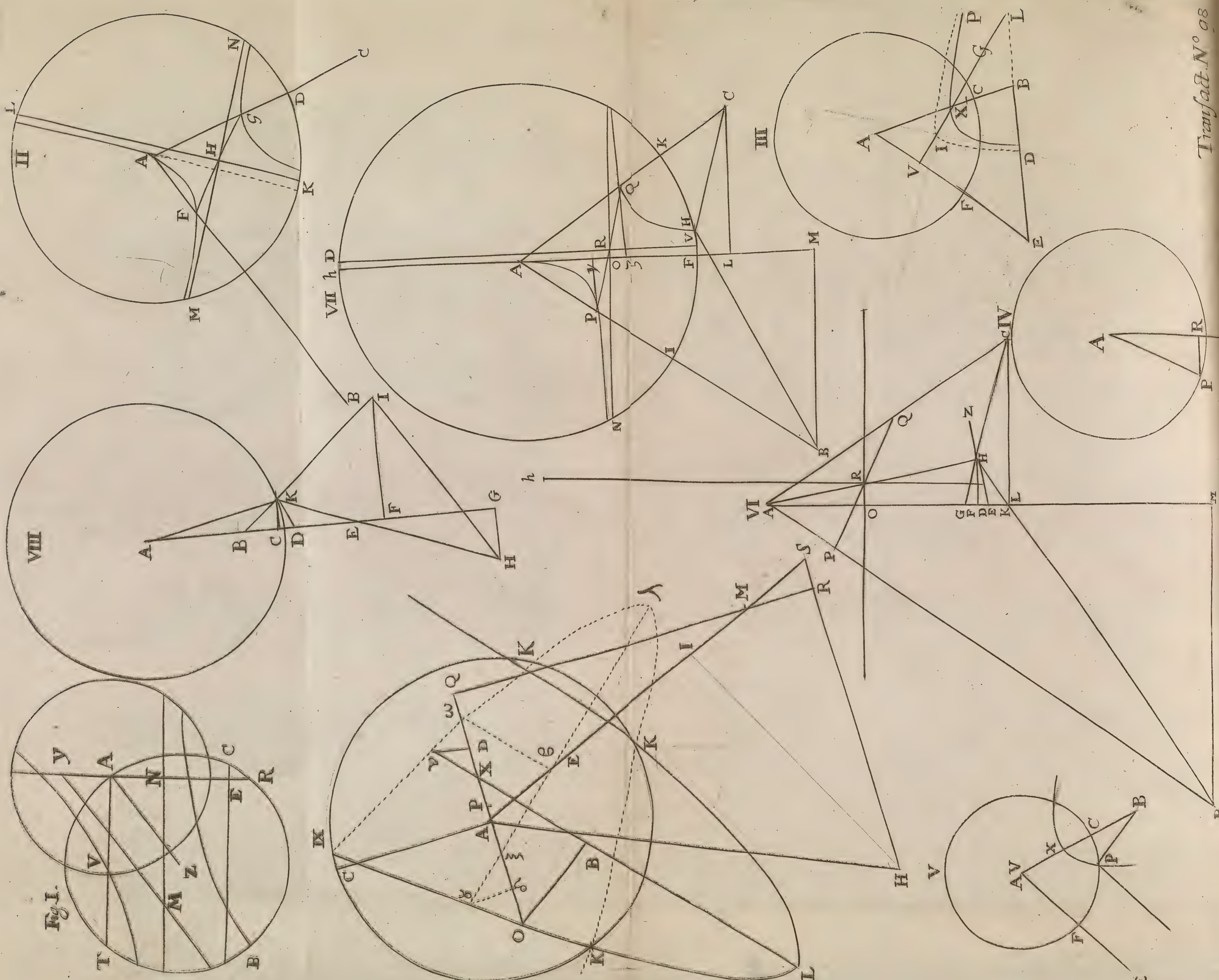
24. That the Humors of the Eyes of Gees and Hens, even the Chry-stallin, have been restored, together with the sight, without any art, by Nature alone, and that perhaps by the afflux of the nervous liquor of the animals.

Errata in this Numb. Pag. 6121. l. ult. leg. DA KC. p. 6123 l. 39. leg. prodibunt. p. 6124. l. 29. leg. cadat radius DE. ibid. l. 37. leg. alterius &c. p. 6125. l. 24. leg. q^a de p. 6126. l. 16. leg. Quod pro quid.

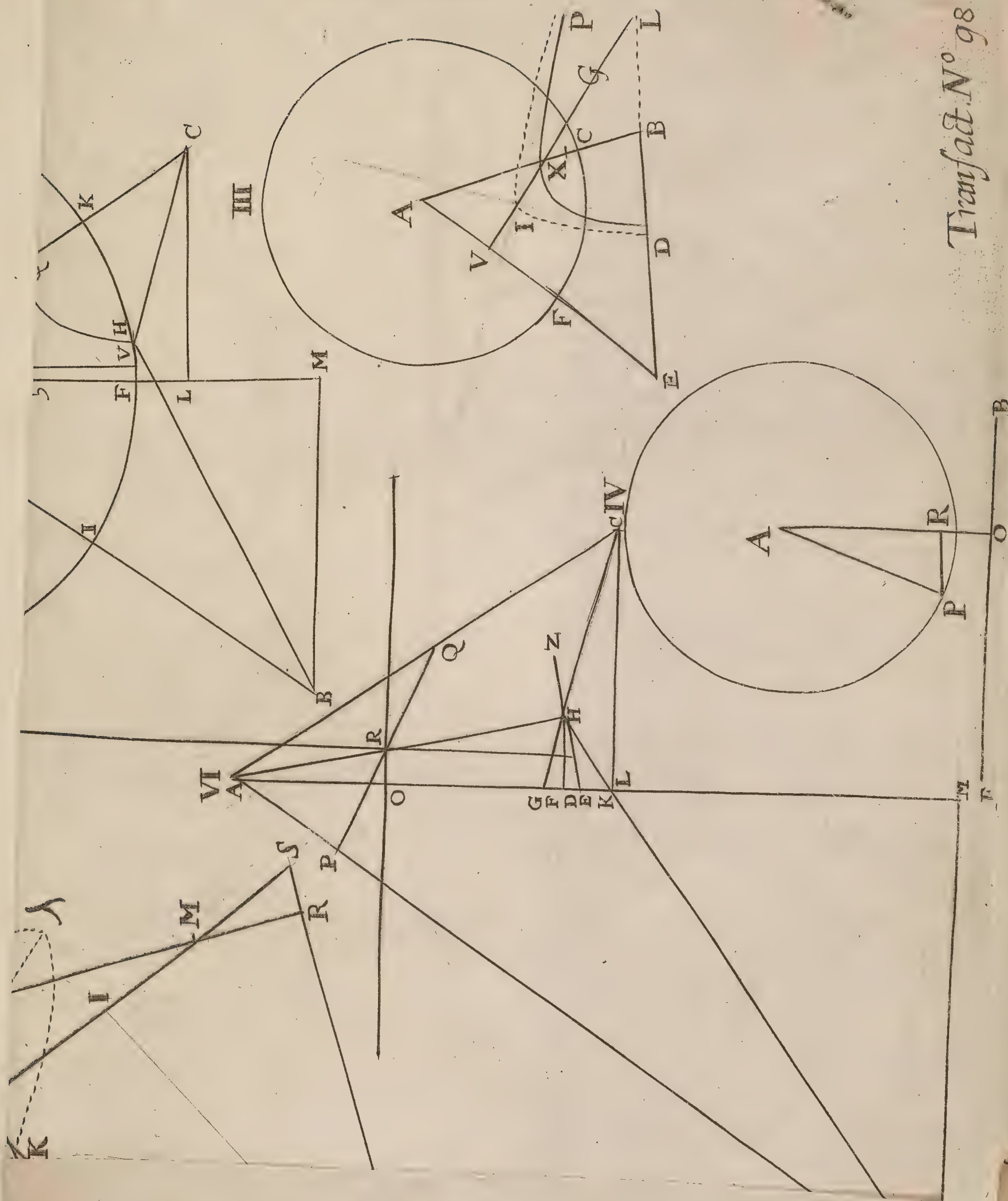
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PHILOSOPHICAL TRANSACTIONS.

Novemb. 17. 1673.

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An Account of the Current of the Tydes about the Orcades, given in by a Gentleman of Scotland, who had pass'd himself that way, and from him communicated to the Publisher by the truly Honourable Sir Robert Moray Knight, deceased, lately one of the Vice-Presidents of the R. Society, of which he had been President formerly; whose Death is no less deservedly than exceedingly lamented by all that knew his Worth, Knowledge, Integrity, Prudence, and Courage.

IN Fairay-Sound (betwixt the Isles of Fairay and Apsa in Orkney) the Sea runneth North-east, for the space only of three hours in Flowing, and nine hours South-west in Ebbing. This is the course of the Tide only in the middle of the Sound, which is but one mile broad.

The next Isle to Fairay, towards the South-west, is *Westra*, which is an Island about five miles in length, and three or four miles in breadth. Upon the South-east side of this Island, within a mile to the shore, lyeth another little Isle, which is not half a mile in Circumference. South and South-west from these two Islands, is *Westra-Frith*, eight miles in breadth, running betwixt them, and the Isle called *Pansa*. Through this Frith the English ships do ordinarily pass, in their course to *Iseland*.

Uuuuuu

Whilst

Whilst the Sea runneth from West to East in Flowing, through this *Westra-Frith*, there are no greater Surges, than in any other place of the Sea; and in a calm day, it is as smooth as any Lake, though there is constantly a great current, in the flux and reflux of the Sea. Yet at the South-East end of the forementioned little Island, the Sea no sooner begins to run westward in Ebbing, but there beginneth a surge to appear, which continually increaseth, until the Ebb be half spent, and afterwards it decreaseth, until it be low water; at which time there appeareth no such thing. East and west from this great Surge, there are some few lesser surges seen, which are gradually less, towards the east and west, after this manner | | | | | I having occasion to pass that way, in a little boat, when we had passed over the Eastmost surges, and were beginning to ascend the biggest, upon the tenth of *April*, at one of the clock in the afternoon, the surge before us was so high, that it intercepted the sight of the Sun, and some deg. of the firmament above it. This surge is about a quarter of a mile in length. When there is any wind, which occasioneth the breaking of the tops of the Surges, there is no passing that way. The current of the Tyde is so strong there, that there is no need of Sails or of Oares, save only to direct the boat, as doth the helm.

Continuatio Excerptorum ex Epistolis Slusianis & Huguenianis, super Alhazeni Problemate Optico, in Actis Philosophicis proximè praegressis commemorato.

DN. Huguenius ad novissimam Dn. Slusii, p. 6123. & seqq. Num. 97. editam, rescripsit Editori, *Lutetiâ Parisiorum* Apr. 9. 1672. in hanc sententiam;

*Est quod Tibi gratias agam, quòd non fuisti gravatus Dn. Slusii super problemate Alhaziano analysin mihi transmittere. Est illa doctissima & Authore suo dignissima; fuitque in causa, dum eam hisce diebus examinarem, ut novis circa problema illud meditationibus me traderem, eò spectantibus, ut constructionem quam possem compendiosissimam maximeque genuinam obtinerem; quam tandem me consecutum esse reor. Eam hîc adscribam, postquam Tibi compendium illud tradidero, quod eodem tempore inveni circa primam, ab initio tibi communicatam. Id autem tale est * : Ductâ lineâ AT , parallelâ CB , eaque bisectâ in V , punctum hoc est illud, per quod transire debet una hyperbolarum oppositarum, quarum asymptoti inventa fuerunt YM , MN .*

Sed en Tibi bonam illam constructionem, quæ in omnibus casibus obtinet †. Sit Circulus datus ED , cujus centrum est A ; puncta data, B & C .

Ductis lineis AB , AC , fiant proportionales BA (radius circuli) & FA : Eodem modo CA , (radius circuli) & GA . Tum jungatur FG , eaque bisecetur in H ; & per hoc punctum ducantur lineæ LHK , MHN , se invicem intersecantes ad angulos rectos, quarumque LHK sit parallela ei, quæ bisecat angulum BAC . Hæ sunt duæ Asymptoti Hyperbolarum describendarum per puncta F & G , & quarum una transibit etiam per centrum A , quarum intersectiones cum circuli

circuli peripheria notabunt puncta Reflexionis quaesita. Hucusque Dn. Hugē-
nius,

Quæ Dn. Slusius ad hæc reposuit trinis epistolis, sic se habent ;

1. Quæ ad Alhazeni problema meditatæ fui hætenus, rudia licet & impo-
lita, tui juris sunt *. De iis igitur dispone prout lubet. Sim-
plicissima est & maximè ingeniosa Nobilissimi Hugēnii con-
structio. Vidit quippe Vir acutissimus, quâ ratione ad omnes
casus extendi posset Hyperbola equalium laterum, quam in
casu anguli recti sese statim offerre præcedentibus meis insinu-
averam. Posset quoque ex infinitis Ellipsis, quæ adhiberi possunt, una seligi
non difficilis constructionis : sed piget tamdiu in eodem Problemate hære. Su-
perest tamen aliquid, quod contemplationem habet non injucundam ; nim. cum
sectiones, quæ cum circulo dato ad Problematis solutionem adhibentur, illum in
quatuor punctis secant, quorum duo tantum reflexioni serviunt, queri posset, quod-
nam Problema solvant duo reliqua, & quânam verborum formâ concipienda sit
Propositio, ut quatuor illos casus complectatur. Deinde, annon etiam iidem qua-
tuor casus occurrant cum puncta data equaliter distant à centro? Vale. Dabam
Leodii VIII Junii CIOIOCLXXII.

* Petierat sc. fa-
cultatem Editor,
hæc in publicum
emittendi.

2. Clar. Hugēnius non aliâ utitur analysi quam meâ, quæ Parabolam uno
tantum casu admittit. Quod ut evidentibus tibi constet, æquationem quam con-
struxit hîc adscribam. Repete memoriâ, si placet, quæ secundis curis ad te scrip-
si, & invenies, me duas æquationes, problemati per Hyperbolam circa asymptotos
solvendo idoneas, assignasse, has nimirum ;

$$2zbaa - 2znae - qqba + qqne = bzqq - zqqe,$$

$$\text{Et } bzqq - 2znae - qqba + qqne = 2zbee - zqqe ;$$

ac (subjecisse, levi mutatione (substituendo, ex.gr. pro qq, ejus valorem aa + ee)
inveniri posse infinitas Hyperbolas & Ellipses, quæ cum circulo dato Problemæ
solvereant. Nunc in priore ex his æquationibus pro bzqq ponatur ejus valor, fiet

$$zbaa - 2znae - qqba + qqne = bzee - zqqe,$$

$$\text{Sive } aa - \frac{qca}{z} = ee - \frac{qqc}{o} + \frac{znae}{b} - \frac{qqne}{zo}.$$

Atque hæc est æquatio, quam magno ingenii acumine, ac pari facilitate con-
struxit vir doctissimus. Quod ut tibi pluribus probem, opus non est, quando la-
bore non multo rem ad calculos revocando id agnoscere poteris. Vale. Dab. Leo-
dii X Junii CIOIOCLXXII.

3. Problematis Alhazeniani memoriâ dudum objeceram, Vir Cl; sed literis
tuis admonitus temperare mihi non potui, quin faciliorem ejusdem constructionem
quererem. Incidi autem nuper in sequentem, quâ breviorẽ cum dari posse vix
credam, committere nolui, quin eam judicio ac censuræ tuæ submitterem. Sint
igitur puncta data E B *, circulus cujus centrum A ; junctis

EA, BA, secantibus circulum in F & C ; fiant tres proportio-
nales EA, FA, VA, & tres iterum BA, CA, XA : tum jun-

*V. Fig. III.

ctâ VX, ac producta utcumque, (vertice X, latere transversa VX, ac recto ipsæ
equali,) describatur Hyperbola XP, cujus applicatæ ad diametrum V X G, pa-
rallelæ sint rectæ AB : illa enim satisfacit proposito in casu speculi convexi, ut
ejus opposita in casu concavi. Si asymptotos desideres, facile reperiri possunt,

productâ VX , donec cum EB , pariter productâ, concurrat in L ; deinde bis
sectâ VX in I , ac sumtâ LD equali LI ; iuncta enim DI erit asymptota
una, in quam alia normaliter incidit ad punctum I .

Sed fortasse ingratum tibi non erit intelligere, quâ viâ ad hanc constructio-
nem pervene im. Scias itaque, me ex priori mea *Analysi de*
* V. Fig. IV. duxisse hoc modo. * Datis iisdem quæ prius, cadat in EB norma-
lis AO , sitque punctum quæsitum P , ex quo in AO cadat norma-
lis PR . Si AO sit b , EO , z , OB , d , AP , q , PR , e , AR , a ; facile
colligitur hæc æquatio

$$\begin{array}{l} 2zdae \\ + 2bbae + ee = aa - \frac{qqa}{b}, \text{ quæ mutari potest in has;} \\ - 2bqqe \\ zb - bd \end{array} \quad \begin{array}{l} zdae \\ + bbae = aa - \frac{1}{2} qq - \frac{\frac{1}{2} qqa}{b} \\ - bqqe \\ zb - bd \end{array} \quad \begin{array}{l} zdae \\ Et + bbae + ee = \frac{1}{2} qq - \frac{\frac{1}{2} qqa}{b} \\ - bqqe \\ zb - bd \end{array}$$

Hujus ultimæ constructionem olim ad te misi; alterius verò, *Cl. Hugenus*.
Primam autem, licet se statim in conspectum dedisset; fermè neglexeram, quòd
difficilioris constructionis esse præsumerem. Sed me vano timore delusum ag-
novi, cum in hanc, quam ad te mitto, constructionem desinere nuper sum ex-
pertus. Sit enim, brevioris calculi causâ, $z - d = K$, $zd + bb = bm$;
fiet.

$$ee - \frac{2qqe + 2mae}{k} = aa - \frac{qqa}{b}.$$

Et additis utrinq; $q^4 + mmaa - 2qqma$, erit

$$\begin{array}{l} ee - \frac{2qqe + mae}{k} + \frac{q^4 + mmaa - 2qqma}{kk} \text{ hoc est, quadratum ex } e - \frac{qq + ma}{k}, \\ \text{æquale } aa - \frac{qqa}{b} + \frac{q^4 + mmaa - 2qqma}{kk}. \end{array} \quad \text{Fiet igitur ἀναλογισμὸς } kk |$$

$$\begin{array}{l} kk + mm | aa - \frac{kkqqa}{bkk + bmm} - \frac{2qqma + q^4}{kk + mm} | \text{ \& quadratum } e - \frac{qq + ma}{k} : \text{ qui} \\ \text{ad æquationem faciliorem reduci potest, si, posito } kk + mm = pp, \text{ fiat} \\ \frac{ky}{p} = a; \text{ sit enim tandem, quadratum ex } e - \frac{qq + m}{k} \frac{y}{p} = yy - \frac{qqky}{bp} - \frac{2qqmy}{kp} \\ + \frac{q^4}{kk}; \text{ quam æquationem superiori constructioni respondere animadvertes, si} \end{array}$$

calculos applicueris; ac simul observabis, ad quamcunque linearum EA , AB ,
 BE , referatur *Analyseos summa*, easdem semper haberi posse sectiones, quam-
vis longiore circuitu & æquationibus valdè diversis.

Ex hac constructione, καὶ ἀναλογίαν deducere licet alterius Problematis
effectiōnem, cum scil. quæritur punctum, à quo radius reflexus
* Vid. Fig. V. parallelus sit cuilibet lineæ datæ; ut, si dato puncto luminoso *
 B , circulo ex centro A , quæreretur radius reflexus parallelus
rectæ

recta AE . Idem enim est, ac si, in alio Problemate, distantia punctorum A & E supponeretur infinita; quo casu tertia proportionalis ipsarum EA , FA , abiret in nihilum, & puncta A & V coinciderent: Itaque VX esset equalis AX , & AE parallela PE . Applica igitur superiorem constructionem, & Problema solves. Descripta scil. (vertice X , latere transverso VX , vel AX , & recto ipsi equali,) Hyperbolâ XP , cujus applicata ad diametrum AX , parallela sint recta AE . *Ἀλλὰ τέτων ἄλεις.* Vereor enim, ne ut olim silentium meum, ita nunc *φλαπίζω* ac scribendi intemperiem incuses. Vale itaque, meq; tui observantissimum amare perge. Dab. Leodii XXII Junii CIOICLXXII.

Sic se habent epistolæ Slusianæ, quibus subjicienda nunc, quæ eas proximè secuta est, Hugonii, data 1. Julii, 1672. Parisiis, in hunc sensum;

Volupe mihi erat cognoscere, quæ mihi nuper ex literis Dn. Slusii communicare voluisti, ipsius nempe Approbationem, nec non doctissimas notas de Problematis Alhaziani constructione. Ecce tibi calculum meum ultimum, à calculo insignis illius Geometræ differentem, quique nativâ indole ducit ad Constructionem illam bonam, quam ante hac ad te misi. Verum est, quin imò mirandum, eam quoque inveniri per calculum quem ipse de ea instituit † post mutationem qq in aa † ee; at hoc videtur fieri casu, nec ibi apparet Constructionis simplicitas nisi postquam eam peragere satagemus.

† V. supra epist.
Slusii dat. Jun.
10.

Problema Alhazeni.

Dato Circulo, cujus centrum A , radius AD , & punctis duobus B , C ; invenire punctum H in circumferentia circuli dati, unde ductæ HB , HC , faciant ad circumferentiam angulos æquales †.

† V. Fig. VI.

Ponatur inventum, ductâque AM recta, quæ bifariam secet angulum BAC , ducatur ei perpendicularis HF , itemque BM , CL . Jungatur porro AH , cui perpend. sit HE , rectisque BH , HC , occurrat AM in punctis K , G .

Sit jam $AM = a$ Quia ergo æquales anguli KHE & CHZ , sive EHG ; $MB = b$ estque EHA angulus rectus, erit ut KE ad EG , ita KA ad AG . Quia verò BM ad MX , ut HF ad FK , $AL = c$ erit, $LC = n$

K

Radius $AD = d$ ut $BM + HF$ ad HF , ita MF ad FK
 $AF = x$ $b + y \text{ --- } y \text{ --- } a = x \mid \frac{ay - xy}{b + y}$ add $FA x$
 $FH = y$ fit $KA \frac{ay + bx}{b + y}$

Rursum, quia CL ad LG , ut HF ad FG , erit permutando & dividendo $CL - HF$ ad HF , ut LF ad FG ,

$n - y \text{ --- } y \text{ --- } c - x \text{ --- } \frac{cy - xy}{n - y}$ quâ ablatâ ab $AF = x$,
 fit $GA = \frac{nx - cy}{n - y}$. Est autem $EA = \frac{dd}{x}$ quia proportionales FA ,
 AH ,

AH, AE . Ergo $EA-GA$, hoc est, EG , $= \frac{dd}{x} - \frac{nx+cy}{n-y}$. Et KA

EA , hoc est, $KE = \frac{ay+bx-dd}{b+y} - \frac{dd}{x}$.

Sed diximus, quod KE ad EG , ut KA ad AG
 Ergo $\frac{ay+bx-dd}{b+y} - \frac{dd}{x} \left| \frac{dd-nx+cy}{x} - \frac{cy}{n-y} \right| \frac{ay+bx}{b+y} \left| \frac{nx-cy}{n-y} \right|$.

Unde invenitur $2anxxy + 2bnx^3 - ddbnx - ddnxy - naddy + nbddx - 2acxyy - 2bcxxy + ddbcxy + ddcyy = -addy - bddxy$.

Et quia $n = \frac{bc}{a}$, fit $\frac{2bbc}{a}x^3 - \frac{bbddcx}{a} - \frac{2bbcyyx}{a}$, quia $xx = dd - yy$

Est autem $\frac{2bbc}{a}x^3 = \frac{2bbcdx}{a} - \frac{2bbcyyx}{a}$, quia $xx = dd - yy$

Ergo $\frac{-2bbcxxy}{a} - \frac{ddbcxy}{a} - 2acxyy + ddcyy = -addy - bddxy$.

Et divisis omnibus per y & ductis in a ,
 $-2bbcxxy - ddbcxy - 2aacxy + ddcaay = -aaddy - bddax$
 $abddx - cbddx + acddy + aaddy = 2aacxy + 2bbcxxy$
 $abddx - cbddx + acddy + aaddy = xy$, quae aequatio est (ad hyperbolam.

Vel quia $bc = na$, $\frac{abdd - anddx + acddy + aaddy}{2aac + 2bbc} = xy$.

Sit $\frac{add}{aa+bb} = p$; Ergo $\frac{pbx - pnx + pcy + pay}{2c} = xy$.

* V. Fig. 7. Unde porrò non difficulter invenitur sequens Constructio * :
 Jungantur BA, AC , & applicato seorsim ad utramque quadrato radii AD , fiant inde $AP, A\zeta$; & juncta $P\zeta$, dividatur ipsa bifariam in R , & per punctum R ducantur RD, RN , sese ad rectos angulos secantes, quorumque RD sit parallela AD , quae dividit bifariam angulum BAC . Erunt jam RD, RN asymptoti oppositarum Hyperbolarum, quarum altera per centrum A transire debet, quaeque secabunt Circumferentiam in punctis H quæsitis. Transibunt autem Hyperbolæ per puncta P, G .

Ratio Constructionis apparet, ductis $P\gamma$ & $\zeta\gamma$ perpendicularibus in AM .
 Fit enim $A\gamma = \frac{add}{aa+bb}$ sive P ; & $A\zeta = \frac{a}{c}p$. Item $P\gamma = \frac{p}{c}$ & $\zeta\gamma = \frac{pb}{c}$.
 Quare $AO = \frac{pc+pa}{2c}$, & $OR = \frac{pb-pn}{2c}$. Unde cetera facilia.

Hactenus Dn. Hugenius. Quibus Dn. Slusius hæc rescrip-

Mirari desine, Vir Clarissime, eandem in Albazeniano Problemate Constructionem ex diversis Aequationibus deduci, quandoquidem illæ omnes, quibus hætenus usi sumus, in una eademque generali Analyfi conti-

*neantur. Quod ut ostendam, datus sit circulus *, cujus * V. Fig. VIII.*

centrum A, puncta H & I; sitque punctum quæsitum K, ad quod ex punctis I & H ducantur rectæ HK, IK, & Tangens KD. Tum ex A ducatur qualibet AG, occurrens HK in E, IK in B, Tangenti KD in D (iis nim. productis, quas produci est opus.) His positis evidens est, ob angulos EKD, DKB, æquales, & angulum AKD rectum, tres AE, BE, DE fore semper harmonicè proportionales. Itaque ductis ad AE normalibus KC, IF, HG, ac denominatis partibus,

<i>AK. q</i>	<i>habebitur, methodo, quam in secunda hujus Problematis analysi olim</i>
<i>AC. a</i>	<i>adhibui, hæc generalis Aequatio,</i>
<i>CK. e</i>	<i>ndaa. bzaa. nqqa + bqaa = ndee. zbeet + 2bnaeet + 2zdae - dqquez zqqe</i>
<i>HG. b</i>	
<i>AG. d</i>	<i>Finge nunc, AG esse perpendicularem ad HI, nihil varietatis erit in</i>
<i>FA. z</i>	<i>æquatione, nisi quod AF & AG, hoc est, d & z, erunt æquales.</i>
<i>FI. n</i>	<i>Posito itaque d pro z, fiet</i>

$$ndaa - bdaa - nqqa + bqqa = ndee - dbee + 2bnae + 2zdae - 2dqqe.$$

Sive applicatis omnibus ad nd - db

$$aa - \frac{qqa}{d} = ee \frac{+ 2bnae + 2zdae - 2dqqe}{nd - bd};$$

Eadem nempe, quam ex prima mea Analyfi, licet aliâ viâ, deduxeram, & quam nuper, modo facili constructam, ad te misi.

Pone deinde, AG coincidere cum AH; abibit igitur HG sive b in nihilum. Expunctis itaque ab æquatione partibus, in quibus b reperitur, remanebit, ndaa - nqqa = ndee + 2zdae - dqqe - qqze. Hanc autem, si meministi, curis secundis inveni, & aliam huic similem, in casu quo recta AG transire intelligitur per I.

Supponamus demum, rectam AG secare bifariam angulum HAI; erit ob similitudinem triangulorum HAG, IAF, ut HG ad GA, ita IF ad FA, sive ut b ad d, ita n ad z, & nd = bq. Ablatis igitur æqualibus, fit, bqqa - nqqa = 2bnae + 2zdae - dqqe - qqze: Illa ipsa, quam, ut ex literis tuis nuper intellexi, Cl. Hugenus construxit.

Intelligatur tandem eadem recta HG secare bifariam rectam HI; erunt igitur æquales HG, IG, hoc est, b = n; fietque, ablatis æqualibus,

bdaa - bzaa = bdee - bzee + 2bbae + 2zdae - dqqe - qqze; quam, licet non admodum difficilem, nemo nostrum hætenus construxit. Hæ autem, ut & ipsa Generalis æquatio, in duas alias dividi possunt, posito, ut nosti, pro aa vel ee, ejus valore qq - ee vel qq - aa.

Vides igitur, quicquid hætenus præstitum est, in eandem Analyfin resolvi; quæ & infinitas alias Constructiones per Circulum datum & Hyperbolam complectatur. Sed eas investigare non est tanti, cum in hoc Problemate, ut olim fortassis inopiâ, sic nunc copiâ laboremus. Addam tantum Constructionem per Parabolam, idque via duplici; quæ licet aliis per Hyperbolam operosior videatur, lineæ tamen simplicitate, qua Parabola inter reliquas sectiones commendatur, operam compensat.

Iisdem

Iisdem igitur datis, jungatur* Al , & producat in S , donec AS fiat
 aequalis AH , junctaque HS , & bisecta IS in M , ducatur
 * V. Fig. IX. per M recta RMQ normalis ad HS , in quam cadat ex A
 normalis AQ , & cui parallelus ducatur radius AC . Tum
 factis tribus proportionalibus IA , AC , AE , fiat ut SA ad AE , ita MQ
 ad AD , & RS ad AP (in recta AQ versus Q ;) & in eadem ab alia parte
 sumatur DO aequalis DC . Demum, bisecta PD in X , inclinetur per X , an-
 gulo semi-recto ad AX , recta VXL , occurrens normali in D recte in puncto
 V , & in quam ex O cadat normalis OB . Ajo, si fiat ut VX ad XB , ita
 XB ad BL , punctum L esse verticem, LV axem, XV latus rectum Parabolæ,
 quæ Problemati satisfacit omni casu; secans nimirum Circulum datum in pun-
 ctis K , quorum supremum & infimum ad Problema Alhazenianum pertinent,
 reliqua ad aliud, de quo nuper ad te scripsi.

Datur, ut supra indicavi, alia quoque Parabola, quæ cum hac paria facit,
 & cujus descriptio ex hac adeo facile deducitur, ut novâ non sit opus. Sumatur
 enim Ad , in directum DA , & ipsi æqualis, & in directum OA , ipsi quoque
 æqualis, Aw . Tum bisecta PD in ξ , ducatur per ξ recta $\alpha\xi\beta$, normalis ad
 XB , concurrens cum Sx , normali ad OA , in α , & in quam cadat normalis
 $\omega\beta$; ac fiat ut $\alpha\xi$ ad $\xi\beta$, ita hæc ad $\beta\lambda$: Erit λ vertex, $\lambda\xi$ axis, $\alpha\xi$ latus
 rectum Parabolæ, quæ in iisdem cum priore punctis Circulum datum secabit. Sed
 de Problemate Alhazeni jam plus quàm satis. Vale, &, quo soles affectu,
 tui semper observantissimum porro prosequi perge. Dab. Leodii prid. Kal.
 Septemb. CIOIOCLXXII.

Epistola Doct. Johannis Wallisi, PRIMAM Inventionem & Demon-
 strationem Æqualitatis lineæ Curvæ Paraboloidis cum Recta, anno
 1657. factam, Dn. Guilielmo Neile p. m. asserens; proximeque
 Dn. Christophoro Wren Equiti, Inventionem lineæ Rectæ æqualis
 Cycloidi ejusque partibus, anno 1658.

Clarissimo Viro, Henrico Oldenburg; Johannes Wallis S. Octob. 4.
 1673. Oxoniæ.

Clarissime Vir,

Q UOD ad Rectificationem istius Curvæ spectat, quam ego Paraboloidem
 Semi-cubicalem appellare soleo; omnino errat Cl. Hugenus (pag. 71,
 72, Horologii Oscillatorii) cum ejus inventionem primam tribuit Johanni
 Heuratio Harlemensi, Anno 1659. Quippe certum est, eandem Biennio
 prius invenisse & demonstrasse Guilielmum Nelium Anglum, Equitis Pauli
 filium: Et, post illum, id ipsum demonstrasse (ne plures nominem) Honoratiss-
 simum D. Vice-comitem Brounckerum, & Cl. Wrennium, Anglos, circi-
 ter menses Junii, Juliique, Anni 1657. atque rem jam tum apud nostros vo-
 tissimam fuisse; utpote inter eos (Geometras aliosque,) qui (Societatis Regiæ
 appellationem nondum adepti) tum solebant in Greshamensi Collegio (ubi ha-
 bitas ibidem prælectiones Mathematicas) statis diebus convenire, publicam &
 cum plausu acceptam. Idque mihi literis suis, Augusto mane tum sequente,
 ad me Oxonium datis, indicavit Honoratissimus D. Vice-comes Brouncker;
 suamque

suamque simul demonstrationem tunc misit; ipsissimam illam, quam, Latine redditam, (ne verbulo, quod sciam, mutato) meamque simul (quæ paulò seriùs secuta erat,) in meâ ad Cl. Hugenum epistolâ, tractatui de Cycloide subjunctâ, post edidi Anno 1659, pag. 93. totamque simul rei gesta Historiam candidè & sincerè inserui. Ut mirum sit, Cl. Hugenum prioritatem temporis Heuratio jam tribuere, si ad illa satis attenderit quæ tum scripsi; Idq; hoc solo pretextu, quòd non apud exteras gentes (nam apud nostros res percce- buit) statim exclamaverit *Εὐρηκα*.

Interea temporis, Cl. Wrennium nostrum, Anno 1658, Cycloidis Curvæ (eiusque partibus) æqualem invenisse Rectam, res erat jam tum nota, non in Angliâ tantùm sed & in Galliâ Belgiôque; ipsique speciatim D. Hugenio (ut ex suis ad me literis constat) ignorato adhuc Heuratii invento; eumque omnium primum id invenisse, in confesso est. Atqui ne ipse quidem Wrennius prætendit se primum omnium invenisse Rectam Curvæ æqualem: Noverat utique, nec dissimulat, id invenisse Nelium anno præcedente. (Nec quidem ignorare poterat; nam, hac occasione, ipse, inter alios, tum statim, post Nelium, id ipsum demonstraverat:) Hanc tantùm sibi prærogativam faciens; quòd ipse Curvam Oblatam Rectificaverit; Nelius autem Curvam potiùs quæsit Rectificationis capacem, (de Paraboloïdum quidem familiâ, sed quam nemo, quod sciam, Nelio prior speciatim consideraverat.) Wrennii verba hæc sunt, (ad calcem suæ de Cycloide demonstrationis, quam ab ipso acceptam subjunxi meo de Cycloide Tractatui, pag. 80. seu rectiùs 73. nam paginarum ibidem numerus perperam notatur;) Quod de nullâ Curvâ hætenus notâ (ne quidem assumptâ Circuli quadraturâ) priùs demonstratum fuit quàm ego hæc de Cycloide primariâ amicis communicaveram; nisi quòd Illustris Juvenis Gulielmus Nelius, curvam quandam ita construendam, ut sit Euthysmi capax, summâ cum laude invenerat. Quæ certè Wrennius non dicturus esset, si Euthysmus ille Nelii non fuisset suo prior; quo tamen posteriorem esse Heuratianum in confesso est.

Eandem autem Nelii curvam esse atque Heuratii, non ambigitur. Eam verò Paraboloeidem esse, non magis dixit Heuratus in demonstratione si a, quàm in suâ; Nelius sed neque ex earum numero esse quarum puncta quælibet Geometricè definiuntur, quod in Neliana desiderat Hugenius; (ut neque hîc Heuratii partes sint quàm Nelii potiores:) quanquam ex utriusvis demonstratione id facile elicitur, (ut nec hic nec ille propterea censendus sit id ignorasse,) ut & ex illa Honoratissimi Brounckeri: (ut de mea nihil dicam; qua nominatim dicitur, & demonstratur esse, Paraboloïdes Semicubicalis:) Et quidem res erat tam manifesta, ut nemo nostrum (quod sciam) de illo quicquam dubitaverit.

Et quidem demonstratio Nelii, prout eam ille primò publicavit, prolixior fuit & fusiùs explicata; sed Wrennii consilio, in brevior formam statim contracta, (quam, mihi petenti missam, edidi,) rescissis omibus quæ non erant ad Euthysmi demonstrationem præcisè necessaria; (ut non mirum sit, ibidem non omnia comparere, quæ aliàs de natura curvæ dici potuissent, utpote ad præsens negotium non spectantia.) Quod postquam à Wrennio resciveram, cupiebam quidem, ut & fusiorem illam formulam conspicerem; sed, cum, ut à

Nelio mihi mitteretur, literis petebam, pro responso nuncium accepi, obiisse Nelium; unde factum est, ut illam non viderim.

Sed perinde est; nam & eodem sensu, (vim demonstrationis quod spectat,) & eodem quasi tempore comparuit utraque; nescio an paucorum dierum intervallo; certè non tanto, ut alicujus sit momenti, Heuratum quod spectat. Et quidem, contractior illa formula, omnia habet ad demonstrationem necessaria; ipso quidem Hugenio proficiente (literis suis ad me datis 15 Julii 1660) his verbis: Fermatii libellum novum simul ad me misit Carcavius, de Curvarum linearum cum rectis comparatione; in quo præcipue agitur de Paraboloïde illa, quam jam ante apud nos Heuratus, apud vos Gu. Nelius rectæ lineæ adæquavit. Post quod non speraveram, ab Hugenio dictum iri (quod jam video) non multum quidem ab invento illo Nelium abfuisse, neque tamen id planè affecutum esse. Atque ego Geometrarum omnium (qui vel D. Brounkeri, vel Nelii demonstrationem à me editam conspexerint) fidem testor, Annon fuerit rem demonstratu susceptam plane affecutus. Sed & Honoratissimum D. Brounkerum testor, annon sua fuerit, atque ejusdem temporis, quam suo nomine Demonstrationem ediderem: Et Cl. Wrennium, (qui & ipse Nelio superstes est,) annon prolixior Nelii demonstratio, fuerit (ejus consilio) in eam formam redacta, atque tum temporis, quam ego edidi.

Audiebam porro, sub idem tempus, idem ab aliis Londini fuisse demonstratum: Sed postquam demonstrationem unam atque alteram vidiissem, fueritque (nemine reclamante) pro demonstrato habitum, non eram sollicitus plures conquirendi. Atque cum Cl. Schotenius librum ab ipso tum nuper editum (cui Heuratianum hoc inventum subjunxit) mihi (pro humanitate sua) dono misisset, meminì, me proximis ad eum literis significasse, Inventum hoc Heuratii id ipsum esse, quod ante duos annos invenerat Nelius; quodque ex eo tempore apud nostros pervulgatum fuit, & à variis demonstratum: quod ipsæ (si extant) testabuntur literæ Novemb. 26. 1659, datæ. Idemque in suis, eodem ipso die ad me scriptis, habet Honoratissimus D. Brounkerus, his verbis, And indeed Heuraets invention is perfectly equipollent to Mr. Neil's, and for ought I know, he might have it from thence. Et quidem abundè testium tum esse posset (dum temporum momenta erant in recenti memoria,) si ulla foret suspicio, post tot tandem annos, litem de hoc negotio motum iri.

Et quidem quod ad reliquas istius Curvæ proprietates spectat, ejusque genuinam naturam, (quas Heuratus non magis quam Nelius tradidit, sed disertis verbis declinat;) saltem Fermatius (ut ut Vir magnus) non modò non tradidisse sed neque tum perspexisse censendus erit. Quippe ille (quod certe non foret facturus, si satis intellexisset curvæ illius naturam,) varia se invenisse Curvarum genera gloriatur; quæ non sunt nisi eadem ipsissima Paraboloïdes, sumptis tantum pro vertice punctis ejusdem curvæ aliis atque aliis. Quod in meis ad D. Kenelmum Digby literis Parisios datis 24 Aug. 1660 (biduo postquam libellum illum, à D. Digbæo ad me missum, primum inspexeram,) demonstravi: Idemque in meis ad D. Hugenum, ejusdem mensis die 31 datis, indicavi. Sed metuo ne nimis videar in re perspicuâ.

Nolim autem ut hac malo animo dicta putes, sive in Heuratium (qui mihi neque beneficio neque injuria notus est,) sive in Cl. Hugenum, quem magni semper habui, atque habiturus sum, & amicissime semper tractavi; ejusq; atq; inventorum suorum non iniquus fuerim estimator; nedum in Fermatium, summum virum: sed ut nuda veritati testimonium perhiberem, Nelioque jam demortuo; iisque ex nostris omnibus, qui, jamdiu ante Heuratium, id ipsum demonstraverant; atque, ne mala fidei habear, in ea quam hac de re narrationem prius edidi. Vale.

Two other Letters to the same purpose with the former: The first of the Right Honourable the Lord Vis-count Brouncker, Chancellor to her Majesty, and President of the R. Society, &c.

S I R,

IT is very sure, that Mr. *William Neil* had in the year 1657. found out and demonstrated a Streight line equal to a Paraboloeid; and did then communicate and publish the same (though not in print) to my self and others, who used to meet at *Gresham Colledge*, and it was there received with good approbation; and the same was, presently afterwards, otherwise demonstrated by my self and others: And therefore ancients than that of Monsieur *Heurat*, which (as it seems,) is not pretended to have been done before the year 1659; and ancients too than that of Sr. *Ch. Wren*, finding a Streight line equal to a Cycloid in the year 1658; and by him admitted so to be. Nor ought it at all to prejudice Mr. *Neil*, that M. *Heuraet's* was somewhat sooner abroad in print, than that of M. *Neil*, (though both in the same year 1659;) since it is well known to many of us, that Mr. *Neil's* was done before. Otherwise M. *Hugens*, by the same reason, will grant the precedency to *Heuraet*, of that which he now claims to be his own invention (that Rectifying the Parabolical Line and Squaring the Hyperbolical Space do mutually depend on each other:) for this was published in print by M. *Heuraet* (or M. *Schooten* for him) in the year 1659, and not by M. *Hugens* till now, 1673: And yet M. *Hugens* thinks, he may well claim that invention to be his own, because he now tells us, that he found it out about the end of the year 1657, and did (some time after) communicate it privately to some friends. And whereas, he doth suppose, that this invention of his might give occasion to that other of *Heuraet*; we may also as well suppose, that he might have taken such occasion from hearing of Mr. *Neil* having done the like, (for this had been then commonly known for a great while:) Or might have taken occasion (as well as Mr. *Neil*) from that of Dr. *Wallis Schol. prop. 38. Arith. Infin.* or from that of Sr. *Ch. Wren* having found a Streight equal to another Curve the year before: Or, if it were necessary to know their symbolization between the Parabolical Line and the Hyperbolical Space; he might have had it earlier from Dr. *Wallis*. For, when he had demonstrated (*Schol. prop. 38. Ar. Infin.*) that the Particles which compose the

Parabolical line, are in power equal to a *Series* of Squares increased by a series of Equals, suppose $\sqrt{A^2 + b^2}$: And (*prop. 35, 41. Conic. Sect.*) that c the Ordinates to the Conjugate Diameter of an Hyperbola, (that is, the particles of which that Hyperbolical space consisteth,) are so also, viz. $\sqrt{\frac{1}{4}T^2 + \frac{T}{L}h^2}$: (where A, T, L , are permanent quantities, and b, h , taken successively in Progression Arithmetical;) It was easie (for M. *Heuraet*, or M. *Hugens*, or any other,) to infer, That, if we can Rectifie the one, we may Square the other, & *vice versa*. But from whence soever M. *Heuraet* had it; we may, as before, reasonably conclude, that Mr. *Neil* had it before him: And M. *Hugens* is a person of that ingenuity, that, when he shall better consider of it, he will (I doubt not) be of the same mind. London, Oct. 8. 1673.

The other Letter is of Sr. Christopher Wren Kt. Surveyor General of his Majesties Buildings, &c.

S I R,

THAT I did, in the year 1658. find a *Streight* line equal to that of a *Cycloid*, and the parts thereof, was then very well known, not in *England* only, but in *France* and *Holland*. And I have not yet heard of any, who do pretend to have known it, before I discover'd it: which was the same year acknowledged in Print by those of *France*. But I do not pretend to have been the *first* that did ever find a *Streight* line equal to a *Crooked*. For I very well know, that Mr. *William Neil* had, the year before, found out and demonstrated, How to construct a *Crooked* line so as to be equal to a *Streight*, by a certain series of Numbers after the method of Dr. *Wallis*. And though He did not therein demonstrate the other properties of that Line; yet the same were presently after demonstrated by myself and others, and the nature of the Line fully discover'd, being a certain *Paraboloëid*. And that which M. *Heurat* is said afterwards to have found out, in the year 1659, and M. *Fermat* in the year 1660, are but the same with that of Mr. *Neile*.

An Accompt of a Book.

De CORPORE ANIMATO Libri quatuor, seu promota per Experimenta Philosophia SPECIMEN ALTERUM; Auth. Johanne Baptista Du Hamel P. S. L. Parisiis, 1673. in 12°.

THis learned Author having formerly published a Treatise of the *Affections of Bodies*, (described in *Numb. 65.* of these Papers,) and therein explained their Qualities, both sensible and others, and such as belong to Bodies in general, and things Inanimate; He thought fit in this piece to give us another Specimen of the Experimental Advancement of Physiology, by treating of that noble subject of Bodies *Animate*; which he doth very learnedly, and modestly, in four Books:

In the *first*, he treats *first* of the Nature and powers of the Sensitive Soul; seeming to incline to the opinion of those excellent men, *Gassendus*, *Fabri* and *Willis*, who esteem the Souls of Brutes to be either Fire, or something having affinity or analogy with it. Then, of Sense, what it is that causeth Sensation; what the Objects transmit into the Sensories; what are chiefly the differences of the Internal senses; what the Imagination; what the *Ingenium* or Witt; whence so great a power of the Memory; from what causes so many and so great differences of Witts; what produces the Appetite and the Affections of the Soul; and many other important subjects belonging to this Head. In which Dissertation he expresses his great wonder at those, that deny *Perception* and *Sense* to Brutes, which he thinks to be as manifest in them, as that they have Organs fitted for it. In the same, he thinks it somewhat incredible, that those Qualities, we call *Sensible*, should have their being and denomination altogether from the apprehension of the Senses; so that, if there were no seeing Eye, there would be no Colour; if there were no hearing Ear, there would be no Sound; if there were no feeling Hand, there would be no Heat, &c. He there also discourses largely and ingeniously of the Causes of the variety of Witts, and what kind of force and faculty is most fit for this or that Art, Science, and Profession; what will make an Orator, a Poet, a Musitian, a Painter, a Physician, a Lawyer, a Divine, a Statesman, &c. When he inquireth into the nature and force of the *Memory*, he taketh pains in assigning not only the cause of its tenacity, lubricity, promptitude of furnishing for delivery; but also the rooms and galleries, to receive and lodge such an infinit variety of movements and phantasms, as occur and present themselves to animals. Where something is annexed relating to *Artificial Memory*. Explicating the nature of the *Affections* and the manner of moving them, he takes notice of that admirable quickness and celerity, with which the impressions are made and transmitted from the Objects through the Sensories to the Fancy; expressing there a species of convenience or inconvenience, and so moving the

the Appetit accordingly by the animal spirits, determin'd by the Fancy to pass into such nerves rather than into others, &c.

In the *second* part he treats of the Organs and Operations of the *External Senses* in particular ; where he descends to various and very curious Observations and Experiments, which do considerably elucidate that subject. Discoursing of the sense of *Touch*, he takes notice of the curious texture of the Skin, being found for the most part nothing but a woof of capillary nerves, arteries and veins, and receiving into it the ends of the excretory vessels arising from an infinit number of little glanduls, through which vessels the sweat and steams do issue. Here also upon occasion he ingeniously assigns the cause of the Blackness of *Negros* ; as also of that sharpness of sweat, that sometimes corrodes and maketh friable mens shirts ; of Rheumatismes ; of Gouts ; of the Lassitude and heaviness in thick and rainy weather, &c ; suggesting withall, several Remedies in such and other cases. When he treats of the *Tast*, he well considers the structure of the Tongue, and the nature of the Spittle, and the great number of the nervous *papille* or little teats in it ; and esteems, that the cause, which so quickly reviveth faint and sometimes dying persons, is, that some of the subtile and most penetrating parts of liquors administred do enter into the said nervous *papille*, and from thence pass, in a moment, into the nerves themselves of the body, and so give new motion and refreshment.

Where he also renders the cause of the *pica* or unnatural appetit in young women, and others.

When he giveth an account of the sense of *Smelling*, he takes notice, with *Dr. Willis*, of the great affinity there is between that sense and the Sight and Taste, and of the ground thereof ; as also of the reason, why some Brutes excell men and other animals in Smelling ; and why men or brutes that are flat nos'd, have a dulness in this Sense, &c. Describing the Sense of *Hearing*, he commends the Loud-speaking Trumpet, lately produced in *London* by *Sir Sam. Moreland* ; adding, that the same may also be conveniently effected by a large and oblong Cone ; and mentioning withall *M. Mariotte's* contrivance of an instrument of a *Parabolical* figure, of very great advantage to a dull Hearing. Treating of the sense of *Seeing*, he explains at large and with much clearness the Fabrick of the Eye, and the whole matter of *Vision*, and much of what is material in Opticks and Dioptricks ; not forgetting what hath lately passed between *M. Mariotte* and *M. Pecquet*, (two considerable Members of the *Royal Academy* at *Paris*,) concerning the proper *Organ* of *Vision*, which the former of them maketh to be rather the membrane *Choroides* than the *Retina* * ; wherein our Author seems to agree with *M. Mariotte*. Nor doth he pass by the Question, why Animals with two Eyes, and Flies and other Insects with many Eyes, do not see one Object double or manifold ? He inquires also, how the Distances, Magnitudes,

* See Numb. 35. and 59. of these Tracts, where this Controversy is deliver'd at large.

nitudes, Figures and Motions of Objects are perceived and estimate by the sight? He delivers likewise the doctrine of Reflexe and Refracted Vision, and that of Telescopes and Microscopes, with more plainness, than many others have done, &c.

In the *third* Book, he explicates what belongs to the Organs and Functions of the *Internal* Senses. Where he discusseth that so much controverted and difficult point about the knowledge of Brutes, and labors to assign the Difference that is betwixt the knowledge of Man and that of other Animals. Then he examines the Structure and Use of the Brain, (referring in many things to Dr. *Willis's* Book on that Argument) and treateth of the *Organs* of the Inward Senses; discussing withall that ingenious opinion of Dr. *Willis*, importing, that the Species's of objects are impress'd in the *cortex* of the Brain, whence the Spirits reflected, cause Reminiscence; as the Spirits fluctuating in the *corpus callosum* produce the act of Imagination; and passing through the *medulla* into the nerves, excite the Appetite, or the instinct to spontaneous motion, whilst the Spirits proceeding from the *cerebellum* produce all motion involuntary. Next, he discourses of *Sleep*, and *Waking*; where he takes notice of those Animals that sleep all the winter long; as also of Night-walkers; likewise of that opinion of Dr. *Willis's*, that Sleep and the Memory have one and the same seat, &c. To all which he subjoineth a discourse of some other Affections of the Brain, as Giddiness, Raving, Phrensy, Melancholy and the like; of all which he acknowledges the said Dr. *Willis* to have written with great learning and solidity.

In the *fourth* and last Book he delivers the Doctrine of the Motion of *Animals* and the Organs thereof. And here he *first* treats of the nature and origin of the Nerves, and observes the difference that is between the *Brain* and the *After-brain*, relating an Experiment made in the *Royal Academy*, by which it appear'd, that the *Brain* being cut in a live animal, the Motion of the Heart and the Respiration ceased not; but all ceased, as soon as the knife touched the *Cerebellum* or *After-brain*. Where he again takes notice of Dr. *Willis's* system, and very candidly professeth, that he knows not, whether any thing in our Age have been invented more ingenious and useful, for explaining clearly the Oeconomy of the whole Animal, and its Functions, both sound and disorder'd. Then, he enumerates all the *Conjugations* of the Nerves; and here, amongst many other things, he observes the cause, why, in all the Perturbations of the Soul, the Eyes, the Face and the Mouth it self, do so exactly answer the Affections of the Heart, as if they were all struck with the same *plectrum* or quill; as he also remarketh with Dr. *Willis*, that the Engin in Brutes is of a slighter contrivance than in Man, forasmuch as in *those* the Heart receives no nerves from the *Intercostal*; whence there is not in *them* that Consent between the Heart and the Brain, that there is in Man. Further, he treats of the *Muscles*, as the chief Instrument of *Spontaneous* motion,

motion, explaining the manner how it is perform'd, and endeavouring to solve the difficulties occurring therein: where he examines, both what *Des-Cartes* hath devised on this subject by assigning a direction to the wagging *Glandula pinealis*; and what *Gassendus* and *Dr. Willis* have suggested on the same, by the flammeous motion or explosion of the Spirits; the former seeming to him altogether fictitious (how ingenious soever;) the latter leaving it hardly conceivable to him, how so constant and even a motion of the Muscles in a sound body can proceed from so violent a cause; nor how the Soul would be able to keep such a command over her motions, if they did depend from an Accension of the Spirits or a violent Explosion. Mean time, he finds it very difficult to make it out, what it is indeed, that causeth the Motion of the Muscles; yet conceives at last, that 'tis the Contraction of their fibres, that produces it; but whether that be done by the accession of some substance, or by a change of angles in the fibres, is a new difficulty, which the Learned *Steno* scruples to determine any thing in, though *Dr. Willis* declare for the former opinion. After this, he enumerates many things, that remain yet unknown to us in the Motion of the Muscles. Which done, he concludes the whole with his ingenious Considerations about the Motion of Walking, Flying, Swimming, Creeping. &c; annexing thereto his doctrine of Passions.

ERRATA in this Numb. 98.

Pag. 6141. l. 20. r. *evidentiùs*. p. 6146. l. penult. r. *plausu*. Ibid. r. *Augusto mense*.

L O N D O N,

Printed for *John Mariyn*, Printer to the Royal Society, 1673.

PHILOSOPHICAL TRANSACTIONS.

Decemb. 22, 1673.

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An Extract of a Letter written by Mr. Christ. Kirkby the 4th of Nov. 1673. from Dantzick, giving an account of an Humane body open'd, and of 38 stones found in the bladder thereof, &c.

SIR,

I Should not have interrupted your studies, if the considerableness of the Relation herein inclosed did not oblige me to send it to you. And although I find in Numb. 26. of your *Philosophical Transactions* p. 482. an account of 96 stones taken out of one bladder; yet, I hope, this of 38 stones will not be unacceptable, since several of them were pretty large,

Y y y y y

and

and of the lesser sort divers were triangular and quadrangular; their flats worn to a great smoothness, and their corners blunted. The greatest stone weighed 206 grains; the least 3 grains; all the 38 weighed $4\frac{7}{8}$ ounces. The matter of the Stones is exceeding compact, and like white clay; and, though the several coats may be discern'd in one of them which I broke, yet they are not easily separable. But what I wonder at most, is, that in the dissection of the Kidneys and Ureters not any sign of stone or gravel was to be found. I leave it to better Judgments to discuss, *How* then and *Where* these stones were generated; and if it be granted, in the bladder, I see no reason but that (as Mr. Boyle somewhere intimates) there might be some liquors, that might pass the several parts of the body without exerting their force, untill they meet with adapted matter to work upon. And why might not then the Stone in the bladder be curable, especially if the Patients kidneys be so qualified as this Man's seem to have been, void of any petrifying matter?

Follows the Relation it self, made by Casparus Wendland, Chirurgion of the City of Dantzick; Englished out of High-Dutch.

MR. John Braun, a Gentleman of 71 years of age, being dead, I was desired to open his body, to see whether we could find the cause of the excessive pains, he had endur'd for two years and an half in the *penis*, with a continual cutting, burning and pressing of his urine, coming from him drop-wise; until at last it came to a constant endeavor of going to stool and of making water, which, a few weeks before his death, ended in a continual running of Urine with very sharp pain; after which about four days before his death, to my knowledge, the water was totally stopp'd. He being dead, I did, in the presence of his Physitian, and other friends, upon the opening of the body, observe the following particulars; *viz.* The internal parts being all carefully examined, we found no defect in them, until we came to the *Bladder*, which being by us taken out, we found it quite full of stones, of which the biggest was of the bigness of a Pigeons-egg, and somewhat larger. Of the bigger sort there were

were 16, yet differing in size. The rest were very small, to the number of 22. The bladder being display'd, we found not a drop of Urin in it, but it had already made, on the side of the orifice of the bladder, an opening of a considerable bigness; upon which, death necessarily ensued. In the Kidneys and Ureters there could not be found the least grain or mark of sand.

An Extract of a Letter, written by Monsieur Denys Novemb. 17. last from Paris concerning an odd fœtus lately born there; English't out of French.

S I R,

A Few days since, I was called to a sick woman, brought to bed that very day I went to see her. After I had prescribed the physick I judged necessary for the mother, I asked for the child, which died, I heard, as soon as 't was born. The Body of it appeared outwardly very well form'd and very fat; but the head was so deform'd, that it frightened all that were present. It had no front; the two eyes were on the top of the face, very big, and almost without an orbite to lodge them in. The upper and hind-part of the Head was red like coagulated blood, and resembled the bottom of a Calves-head when cut and sever'd from the Vertebra's of the neck. I had the curiosity to examine this red flesh, and I found under it a Bone, that was not a hollow skul, but a solid bone in the form of a small oyster. I had it opened every way; but I found no hollowness nor brains in it. This bone was only fastn'd before to the bones of the face, and not behind to the vertebra's of the neck; so that the marrow of the back-bone had no communication with the head. I pursued the Optic nerves, and lost them in this bone, which was in lieu of the *cranium*, and was not at all spungy, but very hard. It seems to me somewhat extraordinary, that a child should be able to live nine months without brains; for I was inform'd, that it was very lively and brisk in the mothers belly, but died as soon as it came into the Air.

An Account of some of the Natural things, with which the Intelligent and Inquisitive Signor Paulo Boccone, of Sicily, hath lately presented the Royal Society, and enriched their Repository.

Amongst the many curiosities, making up this handsome Present, we shall here particularly take notice of these following:

1. Of the un-common pieces of *Coral* red and white; of both which some are ramified in solid massy bodies; others (the rarer sort,) are *Corallin* incrustations upon truly wooden and branchy sticks, and do terminate in small and tender *Corallin* buttons or flowers; in some of which the Presenter affirm'd to have, upon squeezing them, found a *lacteous* Juice. Himself having been present at the Coral-fishing in the Channel of *Messina*, which separates *Calabria* from *Sicily*, relates in a letter of his, written on that subject to Signor *Marchetti*, Professor of the *Mathematiques* at *Pisa*, that, before the Coral-fishers drew their nets out of the water, he immersed his hand and arm into the Sea to feel, whether the Coral was soft under the water before it was drawn up into the air, and found it altogether hard, except the round end, above-mentioned under the name of button; which having been bruised with his nails, he found it made up of five or six little cells, full of a white and somewhat mucilaginous liquor, resembling that milky Juice, found in Summer in the long cods of the herb, call'd *Fluvialis pistana foliis denticulatis*, spoken of by *Joh. Bauhinus*. This *Corallin* juice he calls *Leven*, because having tasted it himself, as well as the Mariners did, they always found it of a sharp and adstringent taste, in such pieces as came recently out of the Sea; those that are dried losing that part of the taste which is acrimonious, and retaining only that which is adstringent: Which change of taste he affirms to be made in about six hours after the Coral hath been drawn up; in which time also the said *Leven*, that is inclosed in the pores, is dried, and hath changed its colour. He inclines strongly to the opinion of those who conceive, that the long concoction of the ferment fixes the parts, and produces the red colour, especially being near to the hard coral, and the red vermillion, which surrounds it.

This

This Observer, having engaged the ingenious Monsieur *Guisony* to impart to him his thoughts concerning that famous Question, *Whether Coral be a Vegetable*, received for answer, That 'tis so far from being a Plant, that 'tis a meer Mineral, composed of much Salt and a little Earth; and that 'tis form'd into that substance by a precipitation of divers Salts, that ensues upon the encounter of the Earth with those Salts; after the manner of the known Metallique Tree, which in a very little time is form'd and increased by the setting and combination of Mercury and Silver, dissolv'd in *Aqua fortis*, and afterwards cast into common water; the parts of this Mineral and Metal joining themselves to one another. Which thing also happens in some subterraneous Grotto's, where by a continual and long fall of water-drops many sorts of figures, and, amongst them, shapes of little trees are formed. This sentiment he confirms by alledging, that he can shew a Salt of Coral, which, being cast into water, and there dissolved, upon the evaporation of that water by a gentle heat is presently coagulated, and converted into store of small sticks, resembling a little forrest.

2. A certain stony substance, that is fissile, and hath the scent of *bitumen*, complicated and laid together membran-like, and found in the *Hyblean* mountains of *Sicily*, near *Milelli*, neighbouring upon the town of *Augusta*, and the ancient *Megara*. Being burnt in a Candle, the bituminous smell will soon be perceived; and 'tis affirm'd, that this stony body, being recently sever'd from its mine and bed, is flexible like paper; but being long exposed to the Air and Sun, becomes frangible. And the herbs, that grow on this stone, do insinuate their fibers and roots between the several coats of the same. It may deserve to have its uses examined, there being found whole hillocks cover'd with it.

3. A not ordinary *sanguisuga* or Leech, found sticking fast in the fish called *Xiphias* or Sword-fish, slightly mention'd by *Gesner* in his book *de Aquatilibus*, and *Johnston* in his book *de Piscibus*. Our Presenter gives it the name of *Hirudo* or *Acus caudâ utrinque pennatâ*, because of its working it self into the flesh, and sucking the blood of the said Fish. He describes it to be of about four inches long; the belly of it white, cartilagi-

nous and transparent ; without eyes or head (that he could observe,) but in stead of a head, it hath a hollow snout encompassed with a very hard membrane, differing in colour and substance from the belly ; which snout it thrusts whole into the body of the fish, (as strongly as an auger is wound into a piece of wood,) and fills it full of blood unto the very orifice. It hath a tail shaped like a feather, serving for its motion, and, under it, two filaments or slender fibres, longer than the whole Insect, whereby, it seems, it clings about stones or herbs, and sticks the closer in the body of the Sword-fish ; of which it attacks those parts only, where the fins of the fish cannot touch or trouble it ; the Observer affirming, that he hath often found it sticking in the back and in the belly, and sometimes close to the head, sometimes close to the tail of that fish, but always far enough from the fins. Within its belly he noted some vessels, like small guts, reaching from one end of it to the other, which by the pressure of his nail he made reach to the orifice of the snout, whence they retired back of themselves to their natural situation ; they seeming to be the instruments for sucking the blood, because the snout is in it self an empty part, destitute of fibres and valves to draw and suck with ; whereas these vessels have a motion resembling that of a pump, in which the snout of this animal serves for a sucker, drawing the blood from one end to the other : And the belly of this Insect being framed ring-wise, the structure serves to thrust the said inner vessels unto the orifice of the trunk, and to draw them back again. This creature as it torments the Swordfish, so it is, by our Observers relation, vexed it self by another Insect, which he calls a *Lomse*, of an ash colour, fastned towards the tail of this Leech as firmly, as a sea-snail is to a rock. 'Tis of the bigness of a pea, and hath an opening, whence come out many small winding and hairy threds. It hath not been observed, (as far as our Author could learn,) to trouble, or to be upon, any other animal than this Leech.

4. A parcel of *Sal Armoniac*, brought away from *Sicily*, where it had been gather'd in the late fiery Eruption of Mount *Ætna*, having been there found copiously, some days after that the fire was extinguish'd, upon the surface of that
fer-

ferruginous matter which was left of the burnt minerals. This Salt, *he saith*, was some of it as yellow as saffron, some like ci-
 iron-colour, some white, and some greenish; which colors
 though they may seem to come from the several sorts of Mines
 of Iron, Brass, &c. whence the Salt issues; yet considering the Ex-
 periment made with it by Signor *Bovelli* in his History of the
 late Burning of *Ætna* (of which an Account was given in
Numb. 75. of these Tracts,) it was a Factitious Salt, such as is
 sold in shops, being a concrete of Niter, Sulphur and Vitriol
 burnt and sublimed. For, it seems, when he found so great
 a plenty of this Salt, and had heard, that the force of Gun-
 powder was highly increased by the mixture of *Sal Armoniac*,
 and thence conceived, that this Salt might have much con-
 tributed to the conflagration of this Mountain, and to the
 fusion of the fabulous, and the fluxing of the vitreous matter;
 he, for a tryal, added some of this *Sal Armoniac* to pulveri-
 sed sulphur and niter; but found, to his amazement, that it
 was so far from being kindled by fire, that it manifestly hin-
 dred the accension of the Brimstone and Salt-peter, which
 were even extinguish'd by it as if water had been powr'd on
 them: And the same happen'd, upon the addition of pow-
 der'd coals, wont to be mix'd in common gun-powder.
 Which Experiment, *he adds*, made him suspect, that this *Sal*
Armoniac, found about *Ætna*, had not been existent in those
 caverns from the beginning, but that 'tis factitious, as was
 hinted above.

For the other particulars of this Present, consisting of
 many *Figur'd Stones*, *Shells*, *Glossopetras*, *Fishes*, *Plants*, *Mi-*
neral Bezoards of Sicily, &c; we shall not here enlarge upon
 them, as being already described in many Authors.

Lunæ ad fixas Appulsus, *Derbia* Anno 1674. observabiles, ab Ephe-
meride Doctissimi D. Heckeri deducti, & brevibus notis descripti à
J. Flamstead.

1673.

Januarii.

6. 4^h-53' p.m. Luna in Υ 14°-00' latitudo Septentr. 5°-16'. Fixa ibi
4°-08' horoscopus Ω 6. Ergo tunc Luna fixam sub Austrino limbo reget,
vel modico ab ea intervallo distabit.

7. 16^h-07' D^x in Π 3°-37'. latitudo 4°-50'; fixa 3°-57' Sept. horosco-
pus \mp 4°. Ergo Luna occidit priusquam fixam assequatur, à qua ta-
men, cum eadem visibili ferè latitudine occasura, limbus ejus orientalis
distabit summum 15' scrup.

10. 4^h-32. D^x in \S 9° 37' latitudo 2°-36' Sept. fixa 1° 31' oriente Ω
6°. Ergo luna limbus Austrinus paulò ante Solis occasum vel fixam
tanget, vel modico interposito intervallo præter-transibit.

11. 5^h-12' D^x in \S 25°-00' latit. borea 1°-07'. fixa 1°-15' horoscopus
 Ω 14° $\frac{1}{2}$: Ergo luna limbus boreus, semihorà circiter ante Solis occa-
sum, transit ferè 30' infra fixam.

Eadem noctè 17^h 14' p.m. digiti 9' cum parte digiti tertia lunaris
corporis obscurantur; & deinceps, horà nim.

19^h 33', Luna erit in Ω 4°-11' cum latitudine Borea 0°-28'. Fixa
ibi latitudo est 0°-04' merid. Propterea tunc Luna limbus orientalis in
eadem cum fixa Azimutha conspicietur, cujus limbus proximus ab ea
distabit.

16' circiter: utilius phainomenon; quippe vix ab umbris terræ Luna li-
berabitur, cum ejus ab hac fixa distantia, tubis capacioribus commodè
mensurari possit. Vigilate bene instructi Calispices.

12. 19^h-27' D in Ω 18°-54'. latitudo Sept. 1°-07'. fixa 1°-15' horosco-
pus Ψ 22°. Luna ergo, circa Solis ortum eandem cum fixa longitudinem
assecta, limbus austrinus ab ea distabit scrupulos circiter 30'.

29. 6^h-37' D^x in \times 22.08 lat. Sept. 3°-36'. fixa 3°-25'. horoscopus Ψ 11.
Ergo sub occasum D^x hora 7^h-50'. fixa erit aliquantulum in antece-
dentia centri Luna & limbo boreo borealior.

Februarii.

2. 11^h-57' D locus Υ 14°-00'. latitudo ejus 5°-14' bor. fixa lat. 4°-08'.
horoscopus m 9. Ergo luna occasura dimidium gradus in antecedentia
fixa cum tanto majori latitudine conspicienda.

3. 9^h-19'. Luna cum lucida Pleiadum latitudinem habet 5°-03'. Sept.
orientem \approx 12: quamobrem post sesquihoram borealiores Pleiadum medio
corpore & limbi obscuri abscondet, sed occidentalem, lucidam, & in
cuspide ad ortum illibatus prætertransibit.

6. 07^h-39'. Luna in \S 5°-25' latitudo 2°-54' Sept. fixa 2°-11' horo-
scopus Ψ 27. Ergo luna circa 7 $\frac{1}{4}$ p.m. fixam abscondet lucis tertiæ
in Australi parte limbi obscuri.

11. $6^h-48'$. D^x in $\text{M} 19^\circ-44'$. latitudo $3^\circ-24'$. Aust; fixa 3-47. horoscopus $\text{M} 21\frac{1}{2}$: propterea limbus Luna orientis, fixa proximus in consequentia ejus 35 saltem scrupulos conspicietur.

13. $10^h-4'$. D^x in $\text{M} 21^\circ-38'$. lat. $5^\circ-00'$; fixa 6-16 Meridionalis; horoscopus $\text{M} 3$: propterea luna orientis limbus proximus distabit circiter 40' scrupulos.

16. $17^h-07'$. D^x in $\text{T} 5^\circ-56'$. latitudo $4^\circ-39'$; fixa 5-50 Australis; horoscopus $\text{V} 27^\circ$: Luna propterea aliquantulum in consequentia fixae videbitur, à qua tamen limbus ejus austratior hand longè distabit.

Martii.

3. $6^h-07'$. D^x in $\text{II} 3^\circ-04'$. latitudo $4^\circ-23'$; fixa 3-57 Sept. horoscopus $\text{M} 27$. Ergo luna circa horam septimam superiori parte limbi obscuri subteget fixam.

15. $13^h-37'$. D^x in $\text{M} 28^\circ-28'$. latitudo 4-41; fixa 5-22. horoscopus $\text{T} 24$. Ergo luna sub ejus occasum, superiori parte limbi lucidi assequetur fixam lucis tertiae.

Aprilis.

3. $7^h-19'$. D^x in $\text{S} 25^\circ-00'$. latitudo $0^\circ-56'$. Sept; fixa 1-15. horoscopus $\text{M} 29$. Luna propterea tunc in eadem cum fixa fere longitudine, limbus boreus ab ea distabit 34' summum.

9. $7^h-29'$. D^x in $\text{M} 21^\circ-38'$. latitudo 4-50 Aust; fixa 6-16. horoscopus $\text{M} 5$. Ergo luna orientis limbus inferior à fixa distabit saltem 30'.

Maii.

22. $15^h-29'$. D^x in $\text{S} 15^\circ-00'$. latitudo Sept. 5-00; fixa 4-08. horoscopus $\text{II} 5$: propterea luna oriens fixam medio limbi lucidi occupabit.

Julii.

3. $10^h-07'$. D^x in $\text{T} 5^\circ-15'$. latitudo Australis $4^\circ-17'$; fixa Antaris $4^\circ-27'$. horoscopus $\text{X} 17$. Ergo luna limbus altior transit 30 saltem infra Antaren, hora $10\frac{1}{2}$: Et sesquihora post, luna occidentis limbus transit fere 30' supra sequentem fixam in $\text{T} 5-56$. cum latitudine aust. 5-50.

20. $14^h-2'$. D^x in $\text{S} 9^\circ-37'$. latitudo $1^\circ-46'$; Sept. fixa 1-31. oriente $\text{S} 13\frac{1}{2}$. Ergo luna recens exorta stellam aliquantulum prætergressa est, à qua tamen limbi vel cornu lucidi distantia, satis forsan commode capi potest.

Augusti.

8. $8^h-59'$. D^x in $\text{X} 22^\circ-08'$. latitudo Sept. $4^\circ-08'$; fixa 3-25 punctum oriens $\text{S} 3\frac{1}{2}$: Ergo luna paulò post 8'. boreali parte limbi lucidi contiget fixam.

12. 16-27. D^x in $\text{S} 14^\circ-00'$. latitudo $5^\circ-03'$. hor; fixa 4-08. horoscopus $\text{S} 25$; quare circa 17 hor. luna limbus austrinus transibit paulò supra fixam.

13. $14^h-33'$. luna in \varnothing $25^\circ-28'$. latitudo $4^\circ-41'$. Pleiades $4^\circ-00'$. punctum oriens Ω $5\frac{3}{4}$. Propterea circa 13 hor. luna medio limbi lucidi abscondet occidentalem lucidiorem. & circa 14 hor. ipsam lucidam, medio nimirum inferioris limbi lucidi quadrantis.

16. $15^h-24'$. D^π in \varnothing $5^\circ-25'$. latitudo $2^\circ-07'$. bor; fixa $2^\circ-11'$. horoscopus Ω $17\frac{2}{3}$. Ergo lune limbus superior transit $30'$ circiter infra fixam hor. $14\frac{1}{2}$.

Septembris.

4. $15^h-09'$. D^π in \odot Solis in \times $22^\circ-08'$. latitudo $4-06$; fixa $3^\circ-25'$. Sept. horoscopus Ω $25\frac{1}{2}$. Ergo ante occasum suum luna abscondet fixam, infra lineam, per centrum ejus Ecliptica ductam parallelam.

23. $6^h-2'$. D^π in \uparrow $5^\circ-15'$. latitudo $3^\circ-54'$. fixa $4^\circ-27'$. merid. horoscopus V $25\frac{2}{3}$. Ergo lune limbus superior circa $6\frac{1}{2}$ p.m. transit paulò infra Antarem; si non ipsam abscondat.

Octobris.

7. $17^h-53'$. D^π in Π $3^\circ-34'$. latitudo Sept. $3^\circ-55'$; fixa $3^\circ-57'$. horoscopus Ξ 15: Luna propterea in eadem cum fixa longitudine circa Solis ortum limbus boreus ab ea distabit $17'$ circ.

Novembris.

3. $8^h-57'$. luna in \varnothing $25^\circ-28'$. lat. Sept. $4^\circ-16'$. Pleiadum lucida tantum $4-00'$. horoscopus Ω $0\frac{1}{2}$. Ergo paulò ante octavam D subteget australissimam Pleiadum limbo austrino, & semihorà post, infra lucidam ibit 5 min. Dignius Phenomenon, quippe luna in oppositu Solis versatur.

5. $8^h-27'$. D^π in Π $20^\circ-55'$. latitudo $2^\circ-36'$; fixa $2^\circ-28'$. Sept. horoscopus \varnothing $26\frac{1}{2}$. Ergo circa $7\frac{1}{2}$ lune limbus superior ibit infra fixam saltem $20'$ min.

30. $17^h-03'$. luna rursus cum lucida Pleiadum latitudinem habet borealem $4^\circ-17'$. oriente m 14° : quamobrem limbus ejus superior mox ibit infra occidentalem lucidiorem 15. & occasura distabit tantundem fere à lucida.

Decemb.

2. $16^h-02'$. D^π in Π $20^\circ-55'$. latitudo $2^\circ-55'$. bor; fixa $2^\circ-28'$. horoscopus m $5\frac{1}{2}$: Ergo lune limbus superior circa horam $17\frac{1}{2}$ ibit 15 min. fere infra stellam, in \odot .

27. $4^h-07'$. luna in \varnothing $14^\circ-00'$. latitudo borea $4^\circ-52'$; fixa $4^\circ-08'$. horoscopus \varnothing 21. Luna propterea stellam longitudine jam superavit, a qua tamen ejus distantiam, tubo capaciorem, dummodò permittat calum, metiri licebit.

Reliquorum quinque Planetarum ad Fixas appulsus Anno 1674. observabiles ab iisdem Ephemeridibus deducti à J. Flamsteed.

	h.	Loci planet.	Latitud.	Distantiæ à fixis in longit.	Latitudine
		s. o			
Januar.	7	6 manè ♂ in ♄ 17--28	0--08 Aust.	2 in consequentia 28 m ⁱⁱ cum	0--28 Aust.
	8	6 manè ♂ ♄ 18--11	0--08 Aust.	4 in antecedentia 29 m ⁱⁱ cum	0--37 Aust.
	12	6 manè ♀ ♃ 10--16	0--09 Bor.	15 in antecedentia 8 ♄ ⁱ cum	0--50 Bor.
	26	6 manè ♀ ♃ 27--45	0--28 Aust.	31 in antecedentia 8 ♃	0--52 Aust.
	30	6 manè ♀ ♃ 2--45	0--36 Aust.	24 in antecedentia 10 ♃	0--51 Aust.
Febr.	4	6 manè ♀ ♃ 8--51	0--47 Aust.	33 in antecedent. 19 ♃	0--18 Aust.
	7	6 manè ♀ ♃ 12--38	0--53 Aust.	32 in antecedent. 20 ♃	0--23 ¹ / ₂ Bor.
	15	6 vesp. ♀ ♃ 13--27	2--20 Aust.	cum 14 ♃ ^{ium} & latitudine	0--49 Aust.
	22	6 manè ♀ ♃ 1--20	1--17 Aust.	24 in consequent. 15 ♃	0--07 Aust.
Martii	19	6 manè ♂ ♃ 9--02	1--08 Aust.	21 in ant. 19 ♃	0--39 Aust.
	25	6 manè ♂ ♃ 13--27	1--13 Aust.	17 in conf. 20 ♃	0--04 ¹ / ₂ Aust.
Aprilis	6	8 vesp. ♀ ♂ 16--46	2--46 Bor.	28 in conf. 9 ♃	1--00 Bor.
	7	8 vesp. ♀ ♂ 17--35	2--47 Bor.	8 in conf. 10 ♃	0--03 Aust.
	9	8 vesp. ♀ ♂ 18--51	2--47 Bor.	2 in ant. 11 ♃	0--11 Bor.
	9	6 manè ♂ ♃ 24--32	1--28 Aust.	16 in conf. 16 ♃ ⁱ	0--32 Bor.
	18	5 manè ♂ ♃ 1--08	1--35 Aust.	13 in conf. 15 ♃ ⁱⁱ	0--25 Aust.
	21	8 vesp. ♀ ♃ 13--27	1--18 Bor.	cum 5 ♃ &	0--04 Bor.
Maii	30	4 manè ♂ ♃ 9--53	1--46 Aust.	10 in ant. 24 ♃ ⁱⁱ	0--22 Aust.
	4	4 manè ♂ ♃ 12--51	1--49 Aust.	10 in conf. 25 ♃	0--49 Aust.
	15	8 vesp. ♀ ♃ 10--33	1--14 Bor.	cum 1 ♃ ^x	0--48 Bor.
Junii	23	8 vesp. ♀ ♃ 9--45	1--13 Bor.	1 in ant. 2 ♃ ^x	0--42 Aust.
	5	9 vesp. ♀ ♂ 9--19	1--03 Bor.	21 in ant. 21 ♃ ^{ium}	0--28 Aust.
	16	4 manè ♂ ♃ 13--29	2--17 Aust.	1 in conf. 14 ♃ ^{ium}	0--46 Aust.
	18	9 vesp. ♀ ♂ 25--13	1--23 Bor.	14 in conf. 8 ♂	0--07 Bor.
	24	4 manè ♂ ♃ 18--53	2--20 Aust.	7 in conf. 16 ♃ ^{ium}	0--43 Bor.
Julii	24	9 vesp. ♀ ♂ 2--32	1--29 Bor.	18 in ant. Præceptis ♂ ⁱ	0--15 Bor.
	29	4 manè ♂ ♂ 10--26	2--23 Aust.	cum 14 ♃ ^{is}	0--57 Aust.
	11	9 vesp. ♀ ♂ 23--14	1--33 Bor.	10 in ant. 16 ♂ ^{is}	0--37 Aust.
	13	9 vesp. ♀ ♂ 25--40	1--32 Bor.	20 in consequentia Cord. ♂ ⁱ	1--05 Bor.
	25	9 vesp. ♀ ♃ 10--14	1--20 Bor.	13 in conf. 38 ♂	0--00
	26	8 vesp. ♀ ♃ 9--42	0--57 Bor.	2 in ant. 2 ♃ &	0--58 Aust.
	28	9 vesp. ♀ ♃ 13--32	1--17 Bor.	19 in conf. 24 ♂ ^{is}	0--23 Aust.
	4	8 vesp. ♀ ♃ 10--37	0--55 Bor.	4 in conf. 1 ♃ & lat.	0--29 B. ver.
	4	8 vesp. ♀ ♃ 22--16	1--04 Bor.	19 in ant. 5 ♃	0--21 Bor.
	11	8 vesp. ♀ ♃ 00--43	0--47 Bor.	24 in conf. 6 ♃	0--38 Aust.
August.	25	8 vesp. ♀ ♃ 13--25	0--50 Bor.	3 in ant. 5 ♃	0--24 Bor.
	28	7 vesp. ♀ ♃ 21--03	0--02 Aust.	16 in conf. 18 ♃	0--17 Bor.
Sept.	15	5 manè ♀ ♃ 14--28	1--02 Bor.	16 in conf. 24 ♂	0--38 Aust.
	18	6 vesp. ♀ ♃ 15--56	1--15 Aust.	24 in ant. 18 ♃	0--33 Bor.
	26	6 vesp. ♀ ♃ 0--00	1--54 Bor.	9 in ant. 6 ♃	0--29 Bor.
	28	6 vesp. ♀ ♃ 27--40	1--50 Aust.	22 in ant. 2 ♃ ⁱ	0--04 Bor.
Octob.	15	6 vesp. ♀ in ♃ 23--03	0--42 Bor.	7 in ant. 11 ♃	0--40 Bor.
	31	5 vesp. ♀ ♃ 5--09	3--01 Aust.	34 in ant. 6 ♄ ⁱ	0--49 Bor.
Novem.	25	6 vesp. ♀ ♃ 7--21	3--02 Aust.	33 in ant. 5 ♃	0--29 Bor.
	11	5 vesp. ♀ ♃ 16--59	3--00 Aust.	30 in ant. 16 ♄ ⁱ	0--08 Bor.
	17	6 vesp. ♂ ♂ 16--21	1--01 Bor.	3 in conf. 9 ♃	0--45 Aust.
Decem.	9	6 vesp. ♀ ♃ 13--28	1--16 Aust.	18 in conf. 20 ♃	0--00
	20	6 vesp. ♀ ♃ 20--58	0--16 Bor.	21 in ant. 37 ♃	0--26 Bor.
	27	6 vesp. ♂ ♂ 16--22	1--51 Aust.	32 in ant. 26 ♃	0--30 Bor.
				4 in conf. 9 ♃ cum lat.	0--05 B. ver.

De Lunæ Eclipsibus tacui ferè, quippe quas amicus quidam in Ephemeride sua accuratius à Theoria Horrocciana supputavit. Saturni & Jovis ad fixas appulsus per noctes aliquot cum præcedentes, tum diem, in tabula conjunctioni conscriptam, sequentes observare licet; Jovisque citius, quippe ejus in Ephemeride Heckeriana motus 13' min. justo tardiores, hoc anno reperiuntur. Commodum foret, etiam ad transitus δ^{us} , η^{us} , & ζ^{us} per fixam nocte tum præcedente tum sequente eam in tabula exaratam attendere, ne ipso tempore minus sit serenum Cælum; quod Cælispicibus serenius quàm per elapsum annum expertus est, hisce Phænomenis observandis exoptat. Derbiæ Dec. 3. 1673. J. F.

An Account of some Books.

1. *PHARMACEUTICE RATIONALIS, sive Diatriba de Medicamentorum Operationibus in Humano corpore: Auth. Tho. Willis M. D. in Univ. Oxon. Prof. Sedlejano, nec non Coll. Med. Lond. & Societ. Reg. Socio. E Theat. Sheldon. 1673. in 4°.*

THE Design and Business of this Instructive and Useful piece is, To give the Mechanical reason of the operation of all sorts of Medicines upon the Animal Spirits in Mans body, and after what manner and how many ways they ferment the Blood and Humors in the same. For the clearer understanding of which, the Excellent Author premiseth an exact Description and Representation of the Stomach and Bowels, in which those Animal Spirits do lodge, and are first of all by the particles of the medicine wrought upon. In the doing of which, he hath in a very accurate manner examined those parts, from the very Mouth to the end of the Bowels; and in each of them very elaborately laid open their Nervous, Muscular and Glandulous membrans, and shew'd the several positions of fibres in them, lying long ways, transverse and oblique, some meerly serving for sense, others for variety of motion; together with the curious woof of the Arteries and Veins, and the rare contrivance of numerous Glanduls.

This being dispatch'd, he makes it his business to explain the principal thing proposed, which, he saith, hath been hitherto one of the *Desiderata* in Physick, viz, In what manner, and by what kinds of impression upon the parts of an Human Body, Medicaments perform their operations, that is to say, How and Why some Medicines are Vomitive, some Purgative, others Sudorifique,

dorifique, others Diuretique, some Alterative, some Cordial, some Opiate; what is the similitude or dissimilitude of the parts in the agent and patient; what their pulsion and reaction; by what kind of struggling or fermentation they, when mixt, are stirred, and by what mechanism or power they produce their several effects? Which things he conceives are not duly solv'd by the vulgar doctrine, importing, that Medicaments do work and exert their peculiar powers by certain specifick vertues; this solution explaining *idem per idem*, and speaking no more than that *e.g.* some medicaments are vomitive, because they are endued with a faculty or power to make the Patient vomit. Wherefore, to satisfie intelligent Readers, he undertakes by a kind of Mechanical way to shew, How Medicines work upon our Bodies, so as to make them, at pleasure, to cause or stop excretions, to raise or allay ebullitions, to remedy the distempers and to remove the disorders of this or that part, &c. In the doing of which he *first*, in reference to the operations of medicines, distinguishes the *Places*, in which they do chiefly exert their vertues, which are *either* the *primæ viæ*, or the Mass of blood with the *viscera* belonging thereto, or the Brain and the Nervous Systeme, with their appurtenances. *Secondly*, he considers the *Immediat Subjects*, on which the medicines operate, which are either the *Animal Spirits*, or the *Humors*: In respect of which he teaches, that Physick taken inwardly does work *either* immediately upon the Animal Spirits, such as lodge in the fibres of the Gullet, Stomach, Bowels and other channels in the *primæ viæ*; or by means of the Blood upon those that reside in the Brain or the Fibers of farther distant parts. When the vertue of medicines reaches to either of these, they either provoke them to excretory motions, or enlarge and refresh them, or allay their disorder, or assuage their fury. As to the *Humors*, on which the Medicaments impress their vertues, they are the Ferments of the Stomach and Gutts, as also the Blood with the Nutritious Juice, and the recrements, as the Serum, the Bile, the Pancreatick Juice, the Lymphatick and Nervous liquor; on which either singly, or plurally, Medicines do work divers ways, either by precipitating them, or by reducing them from that state; sometimes by rowling them when lazy, or by assuaging them.

them when furious; sometimes by altering them when disorder'd in quality, consistence, temperament, &c.

The *Method*, which he observes in treating of all these particulars, is suted to the *places*, wherein Medicines do first of all or primarily exercise their vertues: In regard to which, he begins from

Vomitives, shewing, how the *Gullet* and *Stomach* are affected by them; by what Fibers this Convulsive motion by vomits is made; how it differs from other Convulsions, and from the Evacuation by stool; and that the proximate cause thereof is a vehement Explosion of the irritated Spirits in the fibers of the Carneous tunicle. He inquires next, in what manner Emetic medicines do work; how they differ from Purgatives; why *these* work more gently, *those* more violently; what kind of matter is voided by vomit; the Accidents of vomiting; why in some 'tis perform'd sooner, in others later; in some 'tis stop-ped more easily than in others; what care to be had of the dose? why Vomiting is more efficacious, though more dangerous than Purges? He teaches also, that Vomitives work not by a specifick vertue, nor upon peculiar humors; and informs us, what are the Indications or Contra-indications to Vomiting; what the chief Vomitives, their Receipts, Præparations, and Reason of their operations? What are the Cures of too much Vomiting; what the Remedies against the vitiated ferment of the Stomach; how to cure vomiting caused by the Stomach's debility; viz. when either the Tone of the Fibres is weakned, or the Nerves obstructed?

Hence he proceeds to *Purgatives*, shewing, what matter is evacuated that way; how the excretory motion is naturally perform'd, and by what fibres; how 'tis push't on? That Purging medicines work not by attraction, nor election, but by *Irritation* in the *prima viæ*, and by *Fermentation* in the Blood and Humors. Observing the Differences of Purgatives, and the reasons thereof; how they irritate in the *viscera*, and ferment variously with the blood and humors? That the Præparation of the humors is not necessary to purging; yet what an *Apparatus* there is requisite both as to the Stomach, and the Blood; from what kind of particles depends the purgative power, both the Irritative and Fermentative? The *former* not from Spirit, Water,

ter, or Earth, nor from Salt or Sulphur singly, but from both Jointly; the *latter* almost alone from Salts. The various sorts of Purgatives and their forms, together with the Causes of their working, and an inquiry, why *Purging* medicines are very seldom prepar'd of Minerals, though *Vomitives* and *Diaphoretiques* often? Then the remedies against an *Hypercatarrhis*, and a Narrative of the *London Dysentery*, and the method of Curing it; with several Examples.

As to *Diureticks*, he explains first the affinity between them and *Diaphoreticks*; then shews, of what liquors the matter of Urine is made up, how the *serum* is sever'd from the Blood in the Kidneys, together with the Structure and use of that part? That that separation is made by percolation, yet not without the assistance of a ferment. The Secretion of the *serum* from the blood is ingeniously cleared up by the curdling and un-curdling of Milk; and some ways deliver'd of procuring, hindring, and removing Coagulation. There are also inserted several Experiments of Chymical liquors powred on hot Blood, and the Alterations ensuing thereupon. That the Blood must be preserv'd both from too great thinness, and too much incrassation, if it shall make a due deposition of its *serum*. Further, he distributes *Diureticks* as to several scopes, to matter, and form; gives several Receipts of them, both of such as have a Volatil, or a fixed Salt, or spirituous or sulphureous particles for their basis; adding their respective ways of operation: To all which he subjoins the Preparations of *Sal prunellæ*, Spirit of Niter, Sea-salt, Urine; as also of the Tincture of Salt of Tartar, of the Sulphur of wine, and of the Salt of Amber. This head he concludes with the History of the Disease called *Diabetes*, together with its Cause, and Cure.

Follow the *Sudorificks*. Where he first intimates the difference of Sweating from other Evacuations; and then, having explained the matter of Sweat, he teaches not only the requisits to copious sweating, which are, a more rapid circulation of the blood, a looser contexture of its parts, and an openness of the pores of the skin; but also the differences of sweating: Adding the several kinds and various receipts of Sudorifick medicines; and amongst them the Preparation of the *Bezoardicum Minerale*, the *Antimonium Diaphoreticum*, the Flores
of

of the *Sal Armoniac*, the *Spirit of Soot*, *Gnajakum*, *Box*, *Tartar*, &c: And concluding this part with the Consideration of too plentiful or depraved Sweating, and the way of curing both; where occurs a Learned Discourse concerning the Aptness of taking Cold; and another, of the *Sudor Anglicus*, enriched with notable Examples, and the Method of their respective Cures.

Treating of *Cordials* and *Alexiterials*, he observes *first*, that those Medicines are altogether improperly said to succur the Heart, whereas they rather work upon the Blood and the Animal Spirits than the Heart: *Then* he teaches, what remedies are proper for the Blood, to mend its crasis, or its defective or excessive accension; and what are fit to relieve the Spirits, either by appeasing or quickning them. To which are joyned divers Receipts of *Cordials* and *Alexiterials*, together with the way of preparing them. Besides, under this Head are consider'd the *Passions of the Heart*, its Trembling and Palpitation, proceeding not from a Convulsive motion of the whole Heart, but from a stop and regurgitation of the Blood about the roots of the appendant vessels, and sometimes from other causes. Here also 'tis taken notice of; for what use there are store of nerves inserted in the tunics of the Arteries, *viz.* To convey Spirits to their Motive and Muscular fibres. Where occasionally 'tis observed, that an Artery is mov'd like the Heart, by a muscular motion; which is illustrated by a curious and exact Anatomical description of an Artery. This Head is enlarged with the several remedies of curing the *Passions of the Heart*.

Lastly he treats of *Opiats*; shewing, How they affect the Animal Spirits; in what kind of particles their force consists; in what places they first begin to work; how far their vertue extends, and to what parts; what are the good and bad Effects of *Opiats*; how they may allay pain without sleep; what relief they yield in the Stone and Gout; what help they afford to a disorder'd Pulse, and to Respiration? What mischief they may work, and after what manner? How the Turks and other devourers of *Opiats* are wont to be affected by them, and why they are able to take it in great quantity without harm? And what Cautions are to be observed in the Use of them? To all which he adds the several sorts, *Præparations*, and Receipts of

of Opiats: Where he takes occasion to discourse of the nature of *Opium* it self, and of the parts wherein the Narcotick force consists; shewing withall by Experiments, that it works not equally in all Animals, and particularly not in Doggs, as it doth in Cats and Men; teaching also the preparation of *Opium*, and reckoning up the Opiats both of the Antients and Moderns; and further instructing his Reader, that the best *Menstruum* for making liquid *Laudanum's*, is Spirit of Wine impregnated with the volatilized salt of Tartar; this having a peculiar vertue of speedy dissolving the mass of *Opium*, of taking a Ruby-like tincture, and of somewhat subduing its Narcotick sulphur, and taking away its strong smell. He concludes the whole with his description and opinion of *Helmonts Laudanum*; and with his thoughts of *Tobacco* and *Coffee*.

II. *Johannis Hevelii MACHINÆ CÆLESTIS Pars prior, ORGANOGRAPHIAM ASTRONOMICAM plurimis Iconibus illustratam & exornatam exhibens, &c.* Gedani, 1673. in fol.

THe famous Author of this Work, having given us in the *Preface* a learned Accompt of the Origin and Progress of Astronomy, and of the Succession of the chief Astronomers from the beginning, (amongst whom he accounts the most eminent to have been *Hipparchus*, *Ptolomy*, *Copernicus* and *Brahe*;) and having also taken notice of the Advancement made of that Science in our Age, in *England*, *Germany*, *France*, *Italy*, &c, and consider'd withall, that without a due Restitution of the *Fixt Stars* to their places, nothing considerable and accurate could be perform'd by Astronomers for establishing the Motion of the Planets, and for perfecting Astronomy; He tells us, that he resolv'd to addict himself with all care and diligence to that work: For the prosecution of which, a great *Apparatus* of Instruments being requisite, he giveth us in this *Volume* an ample Description of them, together with his way of examining and rectifying the same: Reserving the *Observations* themselves for another *Volume*; which he intimates to be already committed to the Press.

In this *Tome* then, he *first* treats in general of the Instruments used both by the Antients and Moderns, and of what is chiefly remarkable in them. *Secondly*, he describes in particular

lar his own Instruments, both small and great, especially those that are made of solid metal, his Quadrants, Sextants, Octants, with all their appurtenances, and an account of their uses, divisions, sights, &c. *Thirdly*, forasmuch as Astronomy hath been greatly improv'd by *Telescopes*, he takes occasion to mention, what *Glasses* have been made by himself, and others, especially one that draws 140 foot, made and presented to him out of *Poland* by Signor *Burattini*; for the erecting of which, in a Tube of that length, our Author relates his contrivance, which he affirms to be such, that by the advantage thereof it can be as easily and readily managed as a Tube of 20 foot. *Lastly*, he subjoineth a discourse of his skill and way of grinding Glasses of an *Hyperbolical* figure, and of his actual performances therein; the prosecution of which he recommends to those that are professed Opticians and Artists; his many other studies and labors not permitting him to indulge himself further in that work.

His thoughts of *Telescopical Sights*, and his Exceptions against them, deliver'd pag. 294. & seqq, we leave to the consideration of those, that prefer them to the *Common* ones.

III. *A Treatise of the BULK and SELVAGE of the World, &c.*

By N. Fairfax, M D. London, 1673.

I Must here avow to the Reader, that I was once at a stand what to say of this altogether *Speculative* Treatise, which I found so un-common both for Matter and Form, that I much doubted my fitness of giving the Author his due; yet considering further the Nobleness of the Subject, and the Learned Authors Acuteness in handling it, I resolved to adventure the following Account.

He undertakes then in this Book to evince against divers Writers, that, as *Immensity* and *Eternity* are Attributes only due to the Great Maker of the Universe, so *Room* and *Time*, *Bounds* and *Successive Duration* belong to the World and all Bodies contained therein; that as the World hath Beginning and End, so when we come to the Rim of the world (which I take to be the same with the Author's *Selvedge* of the *Bulk*,) there is all, and nothing at all beyond it.

But then to make a good step towards the knowledge of what the World ought to be to *Us*, whom he supposes to be
Body

Body and Spirit both together, he informs us, what the World is to such Being or Beings as are *Spirit* altogether, in contradistinction to *Body*. Where considering *Room* and *Time*, and laying the one to Gods *Immensities*, and the other to his *Eternity*, he concludes, that *Room* will not bear a coextension to the former, nor *Time* a lengthening out with the latter; but that they are different altogether. And here he disputes against those Authors, that would maintain *Eternal TIME*, and Boundless *BODY*; endeavouring to make it out, that all *Time* is a *Now* to Gods *Eternity*, and all *Bulk* a *Point* to his *Immensities*: Taking also occasion to prove, that *Room* is no where but where *Body* is, and *Spirit* (in the strict notion of the word) no more in *Room* than *Thought* is, and as far from taking up *Room*, as 'tis from putting on *Body*.

Having thus discoursed, what *Body* is to *God* and *Spirit*, he considers, what *Body* is to *Body* and *Us*. In the doing of which, he undertakes to shew, 1. How far *Body* or the World of Bodies may be stretcht out? 2. Into what smallness a Piece of *Body* may be crumbled? 3. How swift or how slow either may be moved? And 4, because the stuff of *Body* is of a more flitting kind, than the substance of *Spirit*, he inquires, How long it hath or might have already been, and how long it doth or may last? 5. Forasmuch as *Body* may shift its Being as well as its Seat, he examines, Whether there may not have been some Bodies or Worlds heretofore, which now are not? Lastly, since one may be a great way distant from another, he inquireth, Whether some are not so far from our place, as to be far also from the World in which we are placed?

In the *first* of these, he examines Dr. *More's* opinion about a boundless *Extension* made by him as needful as *God* is; and, upon occasion of the said Doctors objection, denies, that an Arrow can be shot beyond the rim of the World, or an Arm born out of it, the very Frame of the world hindring it as much, as the stiffest bodies obstruct passage.

In the *second*, he endeavors to shew, that as a *Body* by putting to it cannot be magnified beyond a certain bulk, so by taking from it cannot be lessened beneath a certain smallness; since that which is not boundless one way, cannot be so in its little part. And here he labors to put an end to that puzzling question, Whether a *Body* be made up of a throng of *Indivi-*

sible parts? which being affirmed and maintained by him, he is solving the Objections of those that hold the *Divisibility* of body *in infinitum*.

In the *third*, concerning *Motion*, he seems to have well considered the doctrine of *Elasticity* or Springiness, touching which he affirms, that though it be not Motion, yet 'tis the *Beginning* and as'twere the *Seed* of it, and made purposely for it; and that, as Motion *begins* in a *Conatus* or *Bearing*, so it *ends* in the same: Alledging further, that as a stirr'd body is never at rest or in pause at all, but always either stirring or bearing (which *bearing* is no more rest than stirring;) so he cannot be charged with the uncouthness of a Bodies recovering Motion of it self, after the dying or breaking off of that which moved it; since that cannot be said to be recovered which was never lost, and Motion is not lost, but only lockt up in the *Elater* or *Bearing*; forasmuch as the *bearing* is the *Well-spring* of Motion, as Motion is the *Off-spring* of *Bearing*: As the darting power in the Hand or Soul is not Motion, but the Spring of all that Velocity that is given to things projected; which Spring of motion or *Elater*, as well as the Motion flowing from thence, he conceives is also thrown off together with the projectile, it seeming to him impossible, to make over Motion that may be lasting without a Spring of swiftness, and as impossible to continue a swiftness without the renewing of such a Spring. Whence he takes occasion to explain *Vegetative* motion, and the Nature of *Begetting* ones like, which to him is nothing else but the *Making over of Springs*; as *Seed*, in his opinion, is nothing but a Cluster of bubbles closely engaged together, or a Bottom of Springs closely girt or knit together, which being loosen'd when sown, by the bedewing of the mould soaking in between its crevices, the springs do swell, and the hollows are made wider, &c.

The *fourth* Question he answers, that the World had beginning, and that beginning the world sooner and sooner, would never make it Eternal. Here he takes occasion to evince, that the World is somewhat besides God, refuting those that hold, the World might have been from Eternity. Which done, he maintains, that a Time may be fastn'd on, beyond which the world shall not hold. To the *two last* Questions he answers, That the Plurality of Worlds as much as the Earliness of them
stands

stands upon the same untrusty bottom; and holds it rational to think, the World could not have been sooner, nor bigger, nor more; and that more, or bigger, or earlier worlds would not better declare the Power, Eternity and Immensity of God, than this world doth. For should God have made worlds before or besides this, that so his works might hold a fuller proportion with his *Everlasting* and *Almighty* power, it would not have answer'd that End. For should he have made any worlds many thousands of years before this, there would have been still the same *Everlasting* power before all such worlds, as is before this, and no less: And should he make other Worlds together with or wide of this World, there would be the same *Almighty* power beyond them, that is beyond this.

IV. *Apologema pro URINIS HUMANIS; Authore Antonio Eygel M.D. & Practico Amstelodamensi. Amstelod. 1672. in 8°.*

THis piece, written in the Belgic tongue, consists of 3 Parts: The *first* contains a Defence of the necessity and usefulness of inspecting and well considering the Urine in Diseases; maintaining against those who despise or neglect that consideration, that thence a more general and better Diagnostick can be taken, than from the Pulse it self; because it is part of the *serum* or vehicle of the Blood, with which it runs through all the parts of the Body, and consequently carries off with it self something of the morbidic *placum* or pollution of the same; whereas the *Pulse*, being nothing else but a propulsion of the blood into the Arteries and Veins, made by the Heart, can do little more than discover the discomposed state of the Heart, and possibly the hot or cold constitution of the Body: The same being also very deceitful, forasmuch as 'tis subject to very many alterations from the Exercise of the body and the Passions of the Soul, especially Fear, Anger, Love. Besides which, the Author alledges his own Experience of having found such a Pulse in some Healthy persons, whence any one might have concluded, they were not able to live 24 hours; as also of having met with divers intermittent pulses, and amongst them with one that had ceased, as to his sence, for the space of three meals, and yet all those Patients recovered. He concludes this part with some considerable Examples of his own happy discernment made from the Inspection of Urines; by which also he affirms he hath been enabled

to know, when the Patient was cur'd, and when not : Insomuch that he hath often warn'd the sick, when they would give over Physick, to beware of the danger yet impending on them ; as he hath frequently taken them off from using more physick, when they had a mind to take more.

The *second* part comprehends a Description of human Urines, confirmed by his own Observations of *thirty six* years, and the Authority of Divers Writers. Where the Author first lays down the standard to Judge *healthy* Urine by, such as is made by a sound body of 30 or 40 years of Age; *viz.* That 'tis of a Citron colour, remaining such as tis made, of a moderate both thickness and copiousness, having also a competent sediment, and a due (somewhat strong) smell: Though as to the *sediment* he notes, that in hot Countries, where a great evacuation is made by the pores of the Body, *that* is found not so considerable, in healthy persons, as in cold and moist Climats. As for those, that alledge the death of some Patients with healthy water, even in time; free from the Plague and malignant Fevers, he is perswaded, that they are either unskilful in Urines, or prejudiced concerning them, since it seems to him not more possible, that a man should dye with a healthy urine, than with a sound body and blood ; forasmuch as the urine is mixt with the blood and Spirits through the whole body. And to those that pretend urine to have a healthy appearance in diseases seated in the Spirits, he answers, that he never could find it so, but that upon an intent view such Spirits appear'd like a fiery damp on the top of the Urine, and therefore he would have no body hold their noses over an open Urinal of such water.

Further, he assigns the time for inspecting the Urine, *viz.* when the Concoction is made, not whilst 'tis making, nor long after 'tis made ; in short, the first water after sleep. Then he directs when to Judge of it, *viz.* not as soon as 'tis made, but when 'tis settled, that is, an hour or two after the excretion ; as also, what place 'tis to stand in, to wit, neither in a cold nor hot one, because as the former hinders the settling, so the latter raises the color, and, when 'tis exceeding, causeth even an ebullition, which destroys what should swim in it. Again, the Urine must not be viewed in the Sun, nor by Candle-light, for fear of occasioning false colors ; but in a place neither dark nor bright, holding it at a middle distance. Neither must it be shaken at first when 'tis to be viewed, the better to discern all ; though it may be afterwards, the better to distinguish the things swimming in it. And in the Plague, great pain, and inflammation, it ought to be inspected, first from the top, and then from the bottom.

Next, he considers, what external or adventitious things may cause an alteration in the Urine ; as Rubarb and Saffron may give it a high colour, and a Salat eaten, a greenish ; but this, *he saith*, passes away in three or four hours. Amongst these External things he takes notice of the Temperament, Sex, and Age of people ; all which
may

may cause several diversities in Urine, to be heeded by all circumspect Physicians. Then he notes the effects of the things called *not-natural* upon Urine; whence those that live in a hot Air, and such as do violent, and especially Venereal, exercise, must needs make a high-coloured water.

After this, he examines, what may be discover'd by the Inspection of Urines, and maintains, that thence may be known the Disease, its Cause, Part affected, and Symptoms, *viz.* from the *Substance, Copiousness, Qualities, and Contents* of the Urine: All which he deduceth at large and very particularly.

Concerning the *Substance* of Urine, he distinguish's it into thick or thin, clear or troubled, oily or not oily; and assigns the Causes of each, and their respective significations.

Touching the *Copiousness*, he observes, what quantity of Urine is generally made by sound people? What the cause is of much urine, and what the sign thereof; as also what may be collected from Urine made in a smaller quantity than ordinarily?

As to the *Qualities*; and first the *Smell* of Urine, he teaches, what may be inferred from thence? That divers causes may render it fetid; that some things taken inwardly retain their smell in the Urine, as Turpentine; that some things bred in the body make the water stinking, or at least of a very strong smell, as Ulcers, and purulent matter, especially if it be not digested to a whiteness.

Then for the *Taste* of Urine; that naturally it is saltish and sulphureous; and that 'tis alter'd by the mixture of certain humors abounding in the body; which of what kind they be, is discernable by the Taste, to be made by the Patient himself, and to be told to the Physician.

As to the *Colors* of Urine, he reckons up what are the most remarkable ones, *viz. White, Yellow, Red, and Black*; to which he reduceth pale and citron colour, high-red, green, blew: And then he teaches, what are the general causes of the Colors of Urine? What are the causes of those particular colors, and what they denote? where he examines very particularly the cause & danger of the Blackness, Greenness, and Blewness of Urine, and inquireth, which is worse, *black* or *blew* Urine? Relating, that, though *Galen* affirms, he never saw any one escape death, that made black water, yet he (the Author) hath known some, especially Children, that were saved, even after they had made black urine.

Concerning the *Contents* of Urine, they are, according to our Author, generally of three sorts, the Sediment, things hanging in the Middle, and things swimming on the Top, (called by the Greeks, *ὑπόστασις, ἐναένημα* and *περίλη*;) according to the several degrees of the weight of such Contents. Of all which there is to be observed the *Substance, Colour, Uniformity, and Likeness*. For example, the best Sediment is, that which is moderate in substance and quantity, white, uniform, and alike both for matter and time. Discoursing upon this head, he considers,

ders, out of what stuff the Sediment of diseased persons is made, with a reflexion on *Fernelius*? what is signified by urine that hath no such contents, or little? what by a copious Sediment? what by a broken, white, black, yellow, red, &c. Sediment? That we are not to look for a Sediment in all diseases. Which Sediment is better, thin or thick? This done, he proceeds to the matter hanging in the *Middle*, and swimming on the *Top*, inquiring, what they signifie respectively; whether they note distempers of the middle and the highest part of the body, or not? Taking notice with several Authors, that little clouds on the uppermost surface of Urine, raised in the form of a ring, are a very ill sign in acute diseases, as fore-boding an imminent Phrensy, and death it self.

After this, he declares his opinion concerning the signification of some peculiar Contents in Urine; as Meal, cales, Blood coagulated, purulent matter, ashes, slime, little pieces of seeming flesh, small hairs, woolly filaments, flying dust, damp, tough stuff adhering to the sides of the vessel, something like a spiders webb, bladders, froth, fat, or cream, Sand, and small Stones. Observing with *Ficinus*, that such sand-grains as are bred *in the Body*, are found at the bottom of the Urinal presently after the water is made; but those that are produced *in the Urinal*, do adhere to the sides thereof, and appear not till a good while after the patient hath made water: And noting further, that such sand not sinking to the bottom, but sticking to the sides of the vessel, does not signifie the bodies disposition to the Stone, but the Liver's excessive heat, and a beginning of corruption in the Bowels; nor then necessarily, when they sink, because many do void these grains, and yet are never troubled with the stone: Though, when men cease to void them, and find pain, and make a whitish and thin urine, they then begin to breed the stone within. But then, to know by the sand, whether the stone be breeding in the Bladder, or in the Kidneys, he tells us, that if it be hard and red, 'tis in the latter; if hard and white, in the former. For the many other Contents of Urine, we must, for fear of too much prolixity, refer to the Author; only we cannot but take notice here of a relation, he alledges out of *Plempius* touching a woman of 70 years of age, who in her urine voided store of fat, as yellow as Holland-butter; and had, before that excretion, been troubled with an ague, upon the loss of which she evacuated this fatty matter for some weeks, some days more, some less, some none at all: But yet waxed not leaner, but rather more fleshy; which made *Plempius* conclude, that that fat came from the Kidneys, not from the whole body. *So much for the second part.*

The *thira* is wholly taken up with a Confutation of two noted Physicians, *Forestus* and *Stratenius*, despising the inspectors of Urine, and declaring the Judgment, made of Diseases and their Causes and Seats by the Urine, to be uncertain and false. Of which, for want of room, we cannot particularise in this place.

Errata left un-corrected in Numb. 98.

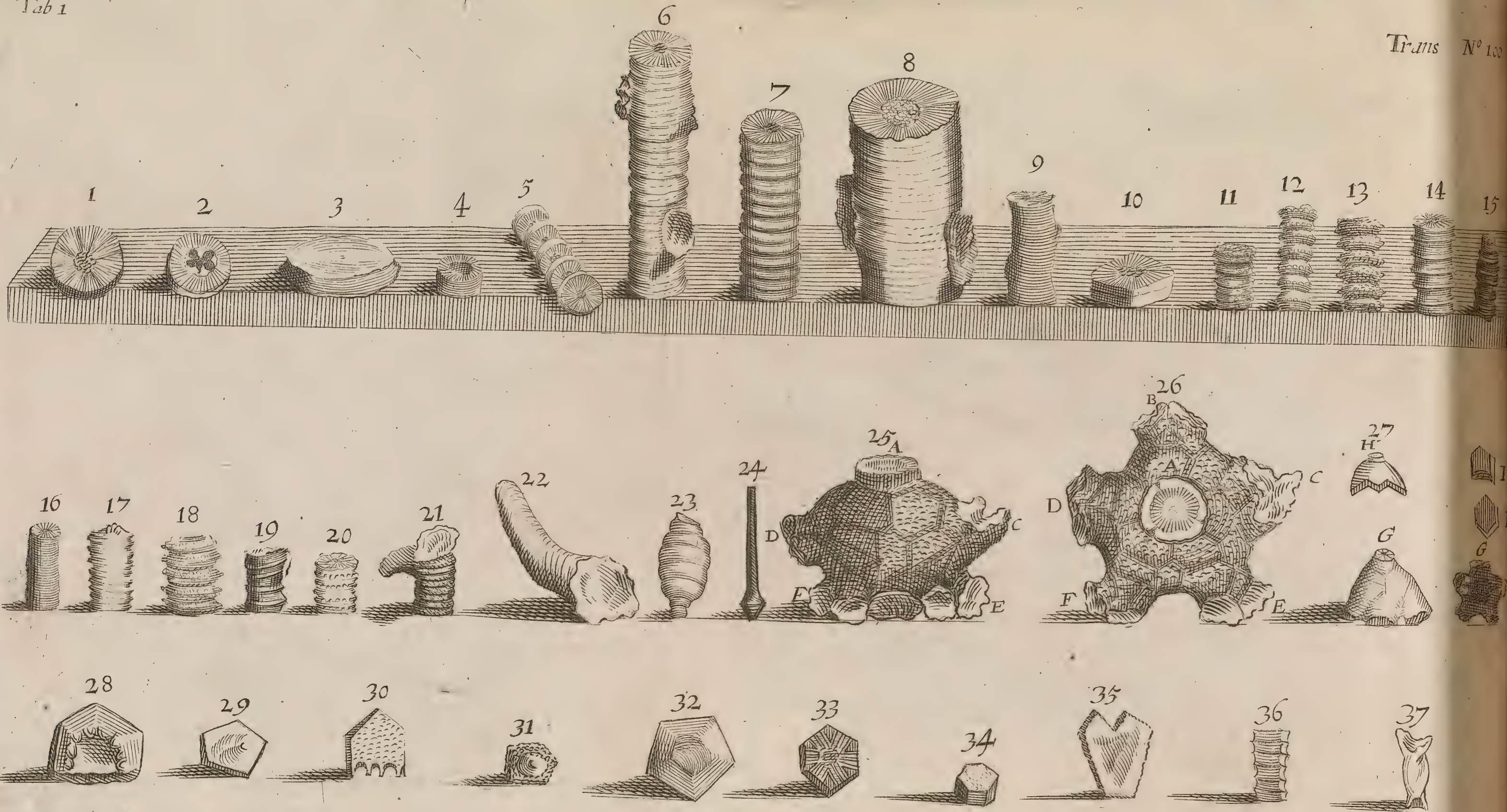
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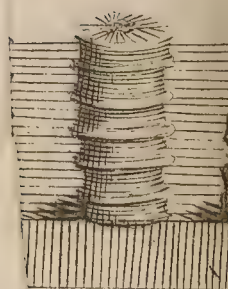
Tab II

Temis No 1









PHILOSOPHICAL TRANSACTIONS.

For the Months of January and February.

February 9. 1673.
74.

The CONTENTS.

An Account of some uncommon Mineral Substances, found in English Coal and Iron-Mines. A Description of certain figured Stones like Plants, supposed by some to be Plants petrified. A Representation of an Icy mountain in Helvetia, formerly described. A Letter giving notice to the Public of a New way of preserving the Hulls of Ships from Worms, &c. The Natural History of Musick. An Account of two Books: I. MUSICA SPECULATIVA del Mengoli. II. Georg. Wedelii Specimen de Sale Volatili Plantarum. An Advertisement concerning a Remedy to prevent the Rot in Sheep, at this present time much complain'd of in England.

*An Account of two uncommon Mineral Substances, found in some Coal and Iron-Mines of England; as it was given by the Intelligent and Learned Mr. Jessop of Bromhal in Yorkshire to the Ingenious Mr. Lister, and by him communicated to the Publisher in a letter of January 7. 1673.
74.*

SIR,

That this Letter may be the more acceptable to you, I shall communicate some *Excerpta*, taken out of the Letters, which that Inquisitive and Learn'd Gentleman Mr. Jessop is pleased to honour me with. I will give, (saith he) the best answer I can in short to the Questions, you put to me in your last.

1. The *Fungus subterraneus*, I sent you a large quantity of, was gotten in a Rocky Lime-stone ground, on a Common about two miles distant from *Castleton* in the Peake of Darbyshire, 15 or 16 yards deep, in the *Old man* (as they call a Mine formerly wrought and stopt up) covered with earth, that had either fallen or was thrown in. There is no coal-bed that is known of within five or six miles of the place.

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Of

Of this *Fungus* by Mr. *Jessops* procurement I received (saith Mr. *Lister*) a good quantity ; and yet I am not able to say, in what form it grows. It does not seem to me to have any constant shape ; at lest the pieces that I receiv'd are much like Peats or Turff, cut up in the high moors, both in the sooty colour and inward substance ; this only is more clammy and tough, and dries not. And some of this fungous substance is very soft and like gelly. In and about the more solid pieces, (of which I have some, half a foot square,) are many big lumps of a *bituminous* substance. This *bitumen* is very inflammable like Rosin ; it is very light, it breaks firm, and shines like good Aloes ; and for color, it is not much unlike it, save that it is more dark-color'd and purplish ; yet there is much of it of a dark green color. We distill'd a parcel of it, which yielded us an Acidulous limpid water ; then, a white liquor, which was, I guess, from some of the Oily parts precipitate. And in the last place, a copious yellow Oyl, not unlike that of *Succinum* or Pitch. In the neck of the Retort we could discern no Volatil Salt, as in the like process upon Amber. Whether this owes its Original to a Vegetable, or is truly a concret Mineral Juyce and a fossil Bitume, I forbear to determine. I have not read of any such fungous Earth, in which *bitumen* naturally grows and adheres : And the finding of it in an Old mine doth much favour the first opinion of being a Vegetable substance ; either the very substance of the propps of Wood, they make use of in lining and supporting the Grooves, thus alter'd, or certain *fungus*'s growing out of them. That Birch, (of which there is great plenty and hath been vast woods all these mountanous parts of *England* over) will yield a *bitumen*, as limpid as the sap is which runs from it by tapping, if we now had the skill to extract it, *Pliny* is very expresse, *l. 16. c. 18. Bitumen ex Betula Galli excoquunt.* And more-over it is certain, that much of that wood, if not all, which is dugg up in the high moors of *Craven*, and which the people there call and use for *Candlewood*, is no other than *Birch*, as it appears from the grain and bark ; and yet this wood kindleth flames, and exudats a rosin, which makes many pronounce it very *Firr-wood*. Whatever this *bitumen* is, which this *Fungus subterraneus* yields, it much differs from the *Asphaltum* of the Shopps ; and you may command

mand a specimen of it, that it may be better examin'd by more skilful Naturalists.

2. There is another Mineral Juyce in these parts of England, which I have much inquir'd after, and have longed to see; and now I am likely to be satisfied, as you may think by Mr. Jessops words: *Captain Wain*, (saith he) a diligent and knowing person in Mines, gave me a White Liquor, resembling Cream both in colour and consistence, which he found in great quantities at the bottom of a Coal-pit, 49 yards deep, which I reserve for you. But this is not all the information that hath been given me about this White Liquor. Mr. George Planton, a curious and very intelligent person, writes thus to me from Sheriff Hales in Shropshire: *I shall trouble you with an Observation, I lately met with in our Iron-mines, especially that which the Country people here call the White Mine, which yields the best Iron-Stone. The Miners do commonly, upon the breaking of a Stone, meet with a great quantity of a whitish milky Liquor, inclosed in the Center of it; they sometimes find a Hogshead contain'd in one cavity. 'Tis in taste sweetish; only it hath a Vitriolick and Iron-like twang with it.*

So far Mr. Lister and his friends, from whose generosity we have received a parcel of each of these substances for further examination.

A Description of certain Stones figured like Plants, and by some Observing men esteemed to be Plants petrified: Communicated to the Publisher by the same Mr. Lister, from York Novemb. 4th. 1673.

S I R,

IN this paper I send you an Account of some of the Parts of certain Stones figured like Plants; which *Agricola* (5^o *Fossilium*) calls *Trochitæ*, and the compound ones *Entrochi*; we in English, St. Cutberds beads.

Agricola will have them akin for substance to the *Lapides Judaici*; and, indeed, these are of an opaque and dark coloured Sparr; though I have of them from some parts of England of a white sparr or *Cawke*, as our Miners call it: They all break like Flint, polished and shining.

Put into Vinegar (saith he) they buble: *Atque etiam repe-*

ritur interdum qui se tanquam Astroites moveat de loco. But this is true of all Fossils of what figure so ever, that Vinegar will corrode and dissolve as a *Menstruum* ; provided they be broken into indifferent small grains, and the bottom of the Vessel hinder not, they will be moved from place to place by it.

The figure of the *Trochita* is cylindrical; the outmost round or Circle (we speak of one single joynt, which *Agricola* calls *Trochites*) is in general smooth, both the flat-sides are thick drawn with fine and small rayes, from a certain hole in the middle to the circumference. From the shooting of these rayes like Antimonie, and because a large Peice of this Stone of many joynts resembles the bole of a Tree, *Aldrovandus* (who yet elsewhere discourses of this Stone, after *Agricola* and *Gesner*, under the name of *Trochita* and *Entrochi*) not improperly terms it (*Musaei Metallici lib. i. pag. 188.*) *Stelechites Stibii facie* ; and there gives us a true figure of it. Two, three, or more of these *Trochita* joyned together, make up that other Stone, which he calls *Entrochos*. The *Trochita* or single joynts are so set together, that the Rayes of the one enter into the others Furrows, as in the Sutures of the skull. Hitherto we agree to what *Agricola*, *Gesner*, *Boetius*, *Aldrovandus* and *Wormius* have said of them: We proceed upon our own Observations, which go much further.

The Places where we find them very plentifully, are certain Scarrs in *Braughton* and *Stock*, little Villages in *Craven*. The Stones of the abovesaid described Figure, as many as have yet come to my hands from those places, have afforded us these Particulars. As to their *bigness*, I never yet met with any much above two inches about; others there are as small as the smallest pinn, and of all magnitudes betwixt those proportions. They are all *broken bodies*; some shorter Pieces, some longer, and some of them, indeed, *Trochita*, that is, but single joynts. I never found one intire piece much above two inches long, and that very rarely too; in some of which long pieces, I have reckned about 30 joynts. And as they are all broken bodies, so are they found *dejected* and lying confusedly in the Rock, which in some places, where they are to be had, is as hard as Marble, in other places soft and *shelly* (as they call it,) that is, rotten and perished with the wet and air.

And

And though in some places they are but sprinkled here and there in the Rock, yet there are whole *bedds* of Rock of vast extent, which are made up for the most part of these, and other figured Stones, as *Bivalve*, *Serpentine*, *Turbinate*, &c. as at *Broughton*.

As to the injuries they have received in their removal from the natural *posture*, if not place of their growth and formation, they are manifest. For, besides their being all broken bodies, we find many of them depressed and crushed, as if the joynt of a hollow Cave should be trod under foot: These Crushes being also real Cracks as of a stone or glass. Again these stones consisting of many *vertebræ* or joynts, they are many of them strangely dislocated; sometimes two, three, or more of the joynts in a Piece are slipped and out of order or rank, and sometimes a whole *series* of joynts, as when a pack of Crown pieces leans obliquely upon a Table. Further, others I have that are twisted like a Cord, if this possibly may be reckoned amongst the injuries. Lastly, some have their joynts, indeed, even and in file, but are yet stuffed with a forrain matter, as when bricks are layed in mortar.

There is great variety as to the thickness of the *Trochite* or single joynts: some are so thin, that they are scarce the full of the 24th. part of an inch; others are a full quarter of an inch thick; of these latter I only found at *Stock*: These, I say, are the extream proportions, as far as my Observations have yet gone; there are joynts of all measures betwixt those two Extreams. This is true in divers Pieces, for mostly the joynts are of an equal thickness in one and the same Piece. Note, that there are slender and small *Entrochi* or Pieces, which have as thick joynts, as the biggest and fairest Pieces.

There is also some difference in the seams or closing of the joynts: Some are but seemingly joynted; which appears by this, that if they be eaten down a while in distilled vinegar, the seeming Sutures will vanish, as in some I had out of *Staffordshire*, from about *Beresford* upon the *Dove*: Others and all here at *Broughton* and *Stock* are really joynted, and the Sutures indented; which indentures being from the terminating of the rayes, they are more fair or large, according to the difference of the rayes, but even, equal, and regular,

We have said, that generally the outmost Circle of each joynt is flat and smooth; yet are there many other differences to be noted as to that Part: Very probably because they are Parts or Pieces of different *Species* of *rock-Plants*.

1. That the smooth-joynted (to say no more of them here) are of different thicknesses as to the joynts.

2. On some *Entrochi* betwixt Suture and Suture in the middle of each joynt, are certain Knots in a Circle; the joynts thus distinguished are very deep and large, and are very frequent at *Stock*.

3. There are likewise of these with a circle of knots, which have many knots besides upon each joynt and look rugged.

4. Some with much thinner joynts, which yet have a Circle of knots in the middle of each joynt; and this also looks as though it was all over knotted, and these are found at *Broughton* only, as far as I know.

5. As some have but one Circle of knots, others are knotted all over the joynt and rough; so are there some others, which have a Circle of larger knots in the middle of each joynt, and a circle of lesser on each side close adjoyning to the border or verge of the Suture. This is huge pretty, and they are found at *Stock*.

6. Others betwixt Suture and Suture in the middle of each joynt rise with a circular edge.

7. A smooth *Entrochos* with a large or much risen edg on the middle of one of the joynts, and a much smaller on the middle of an other joynt and that alternatively.

8. The same alternate difference, the joynts only much rounder and blunt, and here the joynts are visibly one thicker than the other.

9. The same with alternate edges knotted.

10. A double edg in the middle of every joynt; this makes the joynts look as though they were exceeding thin and numerous, but indeed they are not so.

11. A double edg in the middle of every joynt knotted by intervals, or as it were serrate edges.

And these are some of the differences, that I have at present been able to make out. Some of the Pieces of most, if not all, of the differences of these *Entrochi* are ramous, having

ving lesser branches deduced from the greater, and that without order. Some have but few branches on a Piece; others I find so thick of branches, that they resemble a ragged Staff. These *Branches* are deep inserted within the stemm, and by being separated, leave great holes in the sides of it. The rayes in the joynts of the branches run cross to the rayes of the stemm. On thick stemms are sometimes very small branches, but mostly the bigger the stemm, the thicker the branches. Some of these branches are branched again: Yet I find not any of them above one inch intire, and yet adhering and inserted into its stock or bole, and for the most part not above a joynt or two. The Branches are known from the stemm, by being a little crooked and something tapering or Conic.

We meet with but few Pieces (besides the branches) that are not exactly Cylindrical, setting aside the injuries above mentioned, that is, that are not as thick at one end as at the other, and perfectly round, notwithstanding that we said, that there are of them of all degrees of magnitude within the proportions above-named.

And, as we said, it is rare to meet with a Piece, that is not exactly cylindrical; so amongst those few that are not so, some we find tapering at both Ends, and much swelled in the middle. And this is the other *Species* of this Stone, according to the division of *Agricola*: *Entrochi dua sunt Species; aut enim aequaliter teres est; aut teres quidem, sed pars ejus media tumet, utrumque caput angustius est.* But this must not be understood, as though both ends were compleat; for, these are but broken Pieces, as the rest, more swelled in the middle.

Others there are figured like a kind of Fruit, or *Lapis Judaicus*; but these also are truly *Entrochi*, and are joynted notwithstanding this shape. Upon a small Stalk of two or three joynts is suddainly raised an Oval bottom, broken off also at both ends.

To these we shall add what seems to have been *summitates* or *fastigia*; long and slender Pieces with a little jointed button, hollow on the very top; which top seems not to have been divided or broken off from any thing else.

I must not forget, that as they are hollow in the middle (and so it was easy to string them like *beads*, which gave occasion
to

to the *English* name ;) so these hollows are sometimes filled with earth, and sometimes an other *Entrochos* is inclosed like a pair of screws, and which is (as it were) pith to the other. Of these inward *Entrochi* some I have which are transparent. Note, that the hollows or piths are of different bores, but most are round. And yet there are of them in great plenty at *Stock*, whose hollow in the middle is in the elegant fashion of a *Cinquefoil*; and the rayes of the joynts of these *Entrochi* are much deeper and fewer in number, than of any other yet observed by me. These also are smooth-joynted. This is most surprising, and I know not any Vegetable, whose Pith is perforate in such a manner.

Lastly we in these Rocks find certain *rude Stones*, of the bigness of Walnuts, which have many impressions of *Trochite* upon them, as though they had been the roots of them. And when these have been a little cleansed in Vinegar, these impressions appear more than casual ; for, the substance that covers them (if not the Stones themselves) is Sparr, and the impressions are round holes with rayes, like those holes, which we said above the Branches made in the sides of the stock, when broken out from them. *Agricola* makes mention of these also : *Sæpenumero lapis informis reperitur unà cum Trochite & Entrocho, Rotæ in se continens figuram; quæ in eo quasi quædam radix, Trochitis jam abruptis, remansit.*

Although there are indeed certain *lapides informes*, which may with some colour be thought to have been the Roots, from whence some *Entrochi* have been broken; yet are not all such lumps of Stone, on which we discern the *Vestigia* of *Entrochi* to be called *lapides informes*, some of them being most elegantly figured. One or two of them, which I found intire and compleat at *Stock*, amongst very many others strangely shattered and defaced, I shall describe to you.

1. The first is in the fashion of a Pine Apple or Cone, with a hollow bottom, about the half of an inch deep, and as much over at the bottom: On the very Top is the round figure of an *Entrochos* broken off; round about the bottom or *basis* are five single feet at equal distances, in the figure of *Crescents*. This Stone is *incrusted* or made up of angular Places ; viz. the bottom is composed of five plates, which we call Feet ; the middle

dle of the Stone of five other plates, all of a Sexangular figure; and the Top Stone. All other plates are smooth on the outside.

2. The second is a large Stone of the bigness of a Walnut, much after the pyramidal fashion of the other; the bottom convex, about one inch and a quarter over; on the top is the lively impression of an *Entrochos* broken off, or rather a *Trochites* yet remaining; round the *Basis* are five *double points* or Feet at equal distances, all broken off and somewhat in the figure of Crescents. This Stone also is incrustate or covered with Sex-angular plates, which are rough. I can compare the incrustating of these stones to nothing so well, as to the skins of the *Piscis Triangularis*, which *Margravius* describes: *Cujus Cutis (nam caret squamis) figuris Trigonis, tetragonis, pentagonis, hexagonisque mire distinguitur & notatur.*

Of these figured plates I find so great variety in the Rocks, both as to the number of Angles and other beautiful Ornaments, that it has caused in me great admiration. And it will not be amiss, since they manifestly belong, as parts, to the above described stones, to enumerate them, at least, as many as have yet come to my hands. Some of these *angular plates*, I said, are yet visible in their natural place and posture in the described stones: But I find the greatest part of them broken up and heaped together in great confusion in the Rocks. And it will be as hard to set them together, as to skill to tell you, what the figure of an intire *Entrochos* (or the stone to which all the above described parts seem to belong) is: But we will omit no part, that we can justly say belongs unto it. We shall begin with *Pentagonous* plates.

1. The first is a *Pentagonous* Stone, as broad as my thumb-nail (we speak of the fairest of them,) hollow on the one side, like a Dish; convex on the other side, where are certain eminent knots, about the bigness of small pinn-heads, set in a kind of square order: This plate is somewhat thinn at the edges and yet blunt.

2. The second is also *Pentagonous*, and not much narrower than the other: It is, indeed, somewhat convex above, but not hollow underneath; it is smooth on both sides, at least without those eminent knots, which are so remarkable in the other

D d d d d d

plate:

plate: The edges of these are as thin as of a knife, and sharp.

3. The third *Pentagonous* Plate is not near so broad, as either of the former; yet one I found amongst a 100 of this sort, that is full as large as any of the above-described: These are all convex on the one side and somewhat hollow on the other; thick edged; one of the 5 sides only is indented; the indented side is ever the thinnest, and the stone is most sloped towards that side. *Note*, that there are many amongst these last indented sorts of plates, which are channelled on the concave side and otherwise notched.

4. All these *Pentagonous* plates are to be found plentifully at *Broughton* or *Stock*. But I shall not omit in this place the mentioning of one, I by chance espied amongst certain figured Stones, which I had out of the Quarrie near *Wansford*-bridg in *Northamptonshire*, and it probably belongs to these kind of plates I am now in hand with. It has one of the five sides thick indented; the convex part has in the middle a raised *Umbo*, like some antient shields, and round about the sides a list of smaller Studds. We have since had some plates much like this from *Bugthorp* under the Woods in *Yorkshire*. We proceed to remark some differences in the *sex-angular* plates.

5. All these stones are but small, save here and there one: The first of them is but little hollow on the one side, and convex on the other; having the convex-side most elegantly wrought with raised or embossed work, that is, with an equilateral triangle bestriding each Corner, and a single right line in the midst; or, if you will, two Triangles one within another. These we found at *Broughton-fear* only.

6. That Plate-stone which is most common in these Rocks, there being a 1000 of these to be found for one of the other, is *sexangular*, a little hollow on the one side and convex on the other: They are for the most part smooth on the convex side or scabrous only; some are much thicker than others; some being as thick as broad, but most are Plate-like; the sides are very unequal, as in Crystals; sometimes five broader sides and one very small; again two sides broad and four much narrower, and infinite other differences as to the inequality of sides.

Words are but the arbitrary symboles of things, and perhaps

haps I have not used them to the best advantage. Good Design (and such is that I send you, done by that ingenious young Gentleman and excellent Artist, my very good friend, Mr. *William Lodge*,) or the things themselves, which I have all by me, would make these particulars much more intelligible and plain to you.

The Explication of the Figures. See Tab. I.

1. A *Trochites* or single joynt with very fine and small Rayes.
2. A *Trochites* or single joynt with the pith bored through, in the fashion of cinquefoil.
3. A *Trochites* or single joynt, of an Oval figure, the rayes scarce apparent and a very small point in the place of the Pith.
4. A single joynt of two of a middle size, with the pith exceeding large.
5. A pack of single joynts dislocated, and yet adhering in their natural order.
6. A very long *Entrochos* or a piece of many smooth joynts with the branches broken off.
7. An *Entrochos* with smooth joynts not branched.
8. The biggest *Entrochos* I have yet seen, with stumps of branches.
9. A smooth *Entrochos* with very thin and numerous joynts.
10. The largest or deepest joynted *Entrochos*, save the oval one noted in the third figure.
11. An *Entrochos* with very many disorderly knots in each joynt.
12. An *Entrochos* with only one single Circle of knots in the middle of each joynt.
13. An *Entrochos* with three Circles of knots.
14. A smooth *Entrochos*, with a large and much risen edge in the middle of each joynt.
15. Alternate joynts round or blunt.
16. A double edg in the middle of each joynt.
17. Alternate joynts, edged.
18. 19. 20. Certain other differences noted in the Paper, but not perfectly exprest in the Design.
21. An *Entrochos* with a branch of a good length.

22. A branch of an *Entrochos* knocked off.
23. An *Entrochos* fruit-like.
24. A *fastigium* or *Summitas*.
25. A *radix* of an *Entrochos* in *Prospective* : where A is a joint or *Trochites* yet remaining, whence an *Entrochos* was broken off. C. E. F. D. are four of the double feet ; the 5th. being hid.
26. The same *radix* to be seen at the best advantage : A the *Trochites* or *basis* : C. B. D. E. F. the five double Feet. Note also the sex-angular rough plates, which incrustate the stone or cover it all over.
27. A smaller *Radix* with smooth plates and five single Feet : H. the top stone. I. one of the five Feet. K. one of the five angular plates which incrustate the middle of the stone. G. the *basis*, Also the same stone in *prospective*. G. the same with the hollow bottom upwards.

Figures of Plates supposed to incrustate divers roots.

28. A pentagonous plate knotted.
29. A thin edged smooth pentagonous plate.
30. An indented pentagonous plate.
31. The Northamptonshire pentagonous plate.
32. A large pentagonous smooth plate.
33. An hexagonous plate imbossed with angles.
34. An hexagonous plate, as deep as broad.
35. 37. Odd figured plates.
36. A quadrangular plate ribbed and indented.

So far this Letter ; which was soon after followed by another, containing the Learned Mr. Ray's annotations upon the same, which were these :

I received (saith Mr. Ray) your accurate Observations about *St. Cutberds beads*. A strange thing it seems to me, that the broken pieces of those bodies, which you find, I mean, of the main stems, should be of equal bigness from the top to the bottom, and not at all tapering, if they be indeed the bodies of Rock-plants. There are found in *Malta* certain stones, called *St. Pauls Batons*, which I suppose were originally a sort of Rock-plants, like small snagged sticks, but without any joints ; the trunks whereof diminish according to the propor-

proportion of other plants after the putting forth of their branches. Those Roots, that you have observed, are a good argument, that these Stones were originally pieces of Vegetables. Wonderful it is, that they should be all broken, and not one plant found remaining entire : And no less wonderful, that there should not at this day be found the like vegetables growing upon the Sub-marine rocks ; unless we will suppose them to grow at great depths under water. And who knows but there may be such bodies growing on the rocks at this day, and that the Fishers for Coral may find of them ; tho' being of no use they neglect and cast them away. Certain it is, there is a sort of Coral jointed.

A farther Description and Representation of the Icy Mountain, called the Gletscher, in the Canton of Berne in Helvetia ; which was formerly taken notice of in Numb. 49. of these Tracts.

THis account was imparted to us from *Paris* by that worthy and obliging person, Monsieur *Justel*, who had received it from a trusty hand living upon the place, as follows ;

The Icy Mountain, of which I have sent you the Scheme *, deserves to be view'd. The letter *A* signifies the Mountain it self, which is very high, and extends it self every year more and more over the neighbouring meadows, by increments that make a great noise and cracking. There are great holes and caverns, which are made when the Ice bursts ; which happens at all times, but especially in the Dog-days. Hunters do there hang up their game they take during the great heat, to make it keep sweet by that means. Very little of the surface melts in summer, and all freezeth again in the night. When the Sun shineth, there is seen such a variety of colors as in a Prism.

* See Tab. 24

B. is a rivolet, issuing forth from under the Ice, which is pretty deep and extreemly cold.

C. are the Hutts, that were built at the beginning, at a considerable distance from the Mountain ; but at present they are nigh to it by reason of the continual increase which this Ice maketh.

There is such an other Mountain near *Geneva* and upon the
Alps

Alpes. A certain *Capucin* told me, he had been upon the highest of these mountains with a Trader in *Cryſtal*, who having driven his hammer into one of these Rocks, and found it hollow and resonant, made a hole into it, and thence drew forth a substance like *Talk*; which to him was a sign there was *Cryſtal*. After which he made a great hole with Gunpowder, and found *Rock-cryſtal* in it.

A Letter written to the Publisher concerning a New Way, by an English Manufacture to preserve the Hulls of Ships from the Worm, &c; better for ſailing and more cheap and durable than any Sheathing or Graving hitherto uſed.

SIR,

U Nderſtanding you have the trouble to publiſh ſuch new and profitable Experiments as come to your knowledge, I take the liberty to inform you of a New Invention, which hath and no doubt will be of very great benefit and advantage to the public: But the waiting for a full trial of thoſe Experiments offered at for the worlds ſatisfaction, and the continuance of the late War (which is a very bad Nurse to Trade or Projects) has been the reaſon the Work has yet advanced no farther. Some few years ſince, *Sr. Phil. Howard* and *Major Watſon* with great charge and induſtry had found out a New way by a Manufacture of our own to preſerve the Hulls of Ships from the Worm, &c. which is much ſmoother and conſequently better for ſaying, and more cheap and durable then the way of Boards, Pitch, Tar, Roſin, Brimſton, or any Sheathing or Graving hitherto uſed. The King and Parliament being ſatisfied, upon examination, of the great benefit that might redound hereby to his Maſteſty and Subjects in general; for the Inventors encouragement to make the ſame public were pleaſed, almoſt four years ſince, to grant them an *Act of Parliament* for the ſole uſe of this their Invention with penalty and prohibition to all others: In proſecution whereof, Experiments have been made upon ſeveral of his Maſteſty's Ships, *viz.* The *Phoenix*, done three years agoe, has made two Voyages into the *Streights*, &c. and when ſhe was lately taken into the Dock at *Woolwyck* to be repaired, upon view of the Maſter Shipwright and others, her ſheathing was found to be in as good condition, as at firſt doing, and the

the Ship so tight during the whole time, that they were forced to heave in Water to keep her sweet. The *Dreadnought*, a third Rate, done in June 1671; the *Henrietta*, *Lyon*, and *Mary*, all three of the third Rate, and done a year and an half since, being lately layed on ground at *Sheerness* and *Portsmouth*, are found to be all in as good condition, and the sheathing to continue as firm and well as at the first doing; as the Master Builder and Assistant at *Portsmouth* and others have certified. Others of his Majesties Ships have been also done, no doubt with as good success as these; but these only having yet been viewed upon their coming in I mention, not the other.

The *Bread-rooms* also of some of these and many other of his Majesties Ships have been lined within, almost in the same manner the Sheathing is without; which has proved a great preservation of the Bread, as several of the Purfers and Officers of the said Ships have certified, and by reason of its duration must be much cheaper and better then Tyn, which is so lyable to rust, or any way yet used.

Also the *Lead* it self (which is the principal thing used herein) they make so close pressed, smooth, and equal, and of what thickness or thinness desired, that great use may be made thereof about several other things relating to Shipping, &c.

His Majesty and the Lords of the Admiralty have received such satisfaction from the Experiments that have been made of this New Invention upon the Ships aforesaid, that they have given expresse order to the Commissioners and principal Officers of the Navy to sheath all their Ships as shall require sheathing for the future, no otherwise but by the way of this New Invention: And I doubt not (all men naturally pursuing that which appears best and most profitable to them,) this Thing will in little time be understood and embraced by Merchants and others concerned, now when a happy Peace shall give liberty to trade; many very considerable persons amongst them having already acquainted themselves herewith, and declared their approbation, notwithstanding you may meet with some, whose ignorance or interest may make them rayl against it, which in the end will weigh little.

Sir, If you please to oblige the World and the Persons concerned

concerned in the publication hereof in your Monethly Book; I pray, direct such as shall desire to make any use hereof or be further satisfied herein, to Mr. *Thomas Rastell* at the Jerkers Office in the Custome house, or to the said Mr. *Rastell* or Mr. *Francis Dracott* at Mr. *Garrawayes* Coffee-house, where they will be found every *Tuesday* and *Thursday* from eleven to twelve of the clock, and afterwards the same dayes in the *West-India-Walk* upon the Exchange. The said Mr. *Rastell* and Mr. *Dracott* being the persons imployed by the Parties concerned in the management of this Work, they may receive satisfaction from them, that this way of sheathing is as cheap as the other, much more durable, and in many respects more beneficial to the Owners, both in point of charge and advantage in sayling, then any way of sheathing hitherto used. This is all at present from, *Sir*

Westminst. this 7th.
of Feb. 16⁷³
74

Your very humble Servant
John Bulteel.

An Account of two Books:

- I. *MUSICA SPECULATIVA* del Mengoli, Dottor dell' una & l'altra Legge, & P.P. de scienze Mechaniche nello Studio di Bologna: In Bologna 1670. in 4°.

OF this *Italian* Treatise we could give no sooner notice, because it came but very lately to our hands, though it hath been printed three years ago. The famous Author undertakes to give in it a better account of Musick and the reasons of Songs, than has been done hitherto. And whereas among the suppositions of Musick it hath been received for an undoubted Axiom, that *Consonance* is made by the frequent union of two Sounds in striking the *External* Drum of the Ear, (for he pretends there is another Drum) at one and the same time; he affirms to have discover'd this to be utterly false, and maketh it his business to prove it in the 4th and 17th speculation of this Book. In the making of which Discovery he relates to have been assisted by taking an exact view of the *Organ of Hearing* it self; he and his Anatomical friends having there taken particular notice, How the three little bones are fastned to one another and to the two Drums, the *External* and *Internal*, (Anatomists having hitherto spoken but of one only.)

ly,) and to the little Cavern and the mouth thereof; and how they were able to guide the threds through the passage of that cavern. And having carefully observed all these parts, both as they were Joyned together in their respective places, and separate, one by one; he tells us, that then he set upon writing these Speculations. In which he gives us in the first place his *Natural History of Musick*, which being the ground of the whole work, we think it will not be unacceptable to the Reader, to find it here entirely *Englished*; especially since the Book it self is yet very scarce in *England*, the commerce between our and the Italian Stationers being very slow, if there be any at all. But before I here deliver this History, I find my self obliged to take notice, that it, as well as divers other parts of this Treatise, are somewhat obscurely written; which the Reader of the Book it self, though he be well versed both in the Language wherein 'tis written, and in the Argument, will find to be so, whenever he shall have opportunity and leisure to read it: This being premised, the History it self follows.

The Natural History of Musick.

A Sound begins from the collision of two parts of the Air, which parting from one another, make a vacuity as to Air, in which *vacuum* two other parcels of Air do meet and knock one another: And because the two first parcels of Air do incline to return to the center of the collision, but cannot, because the room is taken up, they do part from the center by lines curled and as 'twere recurring to their first place, in the doing of which they make a collision with those parts of the Air that have possessed themselves of *their* room. And thus the *species* of the Sound is multiplied and extended.

These curled lines are more waving *near* the center of the collision, as being more stretch't long-ways than spirally, and less waving when they are further off from the center; in which latter lines, the inclination to return towards the center is prevalent above the impetus of receding from it; so that at last they turn back towards the center. Thus of the *species* of a Sound there is filled a sphere of Air, or such a part of a sphere of it, as this motion of the Air can without impediment spread it self through.

In like manner *two* Sounds, from *two* centers, one within the sonorous sphere of the other, do begin and are distributed through the small particles of the Air, in such a manner, *that* some of the pulses are affected by one sound, and others, without confusion, by the other, and *that* the pulses of the acuter sound are swifter and do compleat their curlings in a shorter time, and the pulses of the graver sound in a longer.

The *Aura* or subtile matter, in which these motions of the Air are made, according to its incomparable sublety, and that property which it hath of being altogether indifferent to any condition of bodies, and suited exactly to represent any motion, or stamp, or weight of other bodies, among which 'tis found; this *Aura*, I say, doth second, and not at all impede the two motions produced by those two sorts of pulses, being moved with all the innumerable intermediat motions. There may also more sounds than two be distributed through the particles of Air, yet not without some confusion. And the more Sounds there are, the more confused will the distribution of the pulses be, especially near the centers themselves, whence the Sounds begin.

The *Ear* is an Organ, by which a man placed in a sonorous Sphere perceives sound, consonancy, and songs. This organ hath three parts; the *exterior*, which is without the Cavity of the Ear, and visibly extant on the head; the *middle-most*, which is the Cavity itself; and the *innermost*, which being within the Cavity, is a stony bone of the form of a sponge, in which is a cavern, recurring to the hollow part of the Ear, and shaped like a knot of ribonds (*ital. nastro:*) And in all the holes of this spungy-like bone there are found webs stretch't out, that enclose the Air congenit or implanted.

The *Middle* part is closed up by *two* membranes, called *Drums*, stretcht over the cavity of the Ear. And of these two, the one is *external*, at the bottom of the exterior part of the Ear; and the other *internal*, upon the mouth of the cavern. And between these Drums there are three small bones, tied to one another, and to the drums, and fastned in two points to the sides of the cavity, and movable, so that if the outward Drum does shake, the inward must shake also, and that twice as often.

The

The inclination of these two Drums is to move in a proportion to the double*; but the exigency of the instrument makes them move differently from their inclination: So that this is the sensitive Organ, in which the Soul is to take notice of what is there acted.

* (Ital. *In proporzione dimidiata della doppia.*)

Between the two drums there is no Air properly so called,* but only an *Aura*, which seconding the inclinations of the drums to motion, and the motions themselves, preserves all the intermediate inclinations and motions. And the reasonable Soul, permanent in its nature, placed in the flitting Body as the Form thereof, hath this natural property, to make what is temporal permanent, that is to say, to stay Time in her self, and to collect all the times of the intermediate inclinations and motions, which are in the *Aura*; in the doing of which, she abstracts from matter two things that are demonstrated to be proportional, as the logarithmes, of the two *Ration's*; one of the drums Inclinations to motion, and the other of the drums motions themselves. Whence the Soul in hearing hath alwayes ready the two *Ration's*, double in act, and half of the double in * inclination; of which she makes use for measures to apprehend all the rations of Sounds.

* Though the Author will admit of no Air commonly so called between the Drums; yet he admits of such Air in the Cavern, and within the *os Petrosum*, the inward part of the Ear; because the Drums would have no motion at all, if there were nothing but *Aura*, for as much as this *aura*, though it may be mov'd by any other thing, yet it cannot be a means to convey motion from one body to another. It is, *saith he*, the internal instrument of the Mover, that lodges there *within*, but not of any Mover that is *without*. See pag. 15.

*(*Doppia in atto, & dimidiata della doppia.*)

If the Ear be within a Sonorous Sphere, the particles of the Air affected by the sound do enter at the external part of the Ear, one after the other, and all pass in order, through the spiral wayes that are there, to the bottom of the Ear, where every one strikes the drum, and after that, by other spiral wayes, issue out of the Ear again, and so give place to other particles of air, that succeed to do the same.

The external drum being struck once, shakes frequently; and, by means of the three little bones, the internal drum answers to it in a double frequency; and the *aura*, in the cavern

of the cavern of the internal part of the Ear, alternately goes and comes through its knot-like passage, and spreads it self through the other wayes of the spongy-like bone, and being repercuſſed to the webs that cloſe it, rebounds and multiplies the ſound. Another parcel of Air follows, and ſtrikes the drum again, and cauſeth the ſhaking as before.

But if the Ear be within two Sonorous Spheres, the affected pulses that cauſe the ſound, do ſucceed the one amidſt the other, by turns, to ſtrike the outward drum; and by the exigences of the alternations, the ration's that are not expreſſible by numbers become to be ſo, and that *both* of ſuch numbers, as can be diſtributed amongſt the particles of the Air, and of ſuch alternations, as that amongſt the ſtrooks, the ſhakings of the drum may be all numbred. And the ſoul perceives the numbers of theſe alternations, and the numbers of the ſhakings of the drum amidſt the ſtrokes of the two ſounds: And whilſt the *aura* that is affected by the two ſounding bodies, does communicate with the *aura* between the drums, ſhe there takes alſo notice of the Logarithme of the *ration* of ſounds, and commensurates it with the Logarithmes of the *ration's*, the double, and its half.

Now, for as much as the Soul pleaſeth her ſelf with two ſounds together, and with the ſucceſſion of many ſounds one after an other, that occur in one Song, 'tis neceſſary ſhe ſhould comprehend in the *Senſe* theſe three things which ſhe perceives, without any abſtraction of the *Mind*. The numbers of the alternation muſt needs be eaſy to make, and two in one ſole numeration. The commensuration of the Logarithmes muſt be made by the way of an eaſy diſiſion into parts, and into a number of parts eaſy to be numbred.

And becauſe it is not poſſible precisely to accord theſe two things equally, ſome errors muſt needs happen, which may be all perceived by *Reaſon*, but cannot all be alike taken notice of, by *Senſe*: Some are inſenſible, ſome altogether intolerable and abſurd, others between both; and of theſe, ſome are nearer to the inſenſible ones; others, to thoſe that are intolerable: Of which errors, convenient eſtimates are given, and according to the differences of thoſe errors the *ration's* of ſounds are diſtinguiſh't.

Laſtly,

Lastly, because it is not possible equally to adjust these two things with the numbers of the shakings of the drum; 'tis necessary, that the soul, desirous of the delight, in the earnest attention to the sound do invigorate her self, and be busy and intent about the outward drum, drawing and restoring it from time to time, more or less; that so the numbers of its shakings may answer to the alternations of the touches, and to the logarithms of the most easy numbers and parts that's possible: In the doing of which, she learns the Tune which she hears, and keeps it within her, and is glad to find herself moved by various affections, sometimes to stretch the drum, sometimes to relax it, otherwhile to leave it in its natural tension, with a certain order, and for certain cases of the sound, which in the Tune do occur to her.

So far his History of Musick; which being premised by him, he gives us a very particular and minute Description of the *Ear*, of *Sound*, and of *Hearing*, especially of the Hearing of two sounds together; where occur many *Theoremes*, by him laid down as the chief Foundation of his whole work. Which done, he treats of all sorts of *Musical Intervals*, their perfection and Measure; explicating this doctrine also by many *Theorems*, and giving withal the Definitions of the several Intervals, and taking particular notice of six sorts of them, for which having found no names, he thought fit to borrow names for them from *Colors*.

Next, he discourses at large of the *True Numbers* of Sounds, and of the various properties thence resulting for Musical Intervals; all which he likewise elucidates with divers considerable Theorems; shewing withal, between what true numbers of Sounds the *Species* of each Interval is most perfect; and teaching, that the rational Soul by her active and earnest attention gives the *true* number to the *first* Sound, that in the Ear is exhibited to her.

Further, he treats of Musical *Chords*; then of *Singing*, and the *Modulation* or Tune; which latter he distinguishes from Singing in general, by this, That it is such a kind of Song, as impresses it so strongly upon the Soul, as to incline her to sing it over and over again. Here, by the help of a *Table*, he shews to have composed in order all the *Species* of possible Modulations or
Tunes.

Tunes in every Tetrachord, and reduced them also to a Table.

Besides this, he discourses amply of the *Accord of more* pag. 190. *Sounds*, and of *Harmonical Proportionality*; as also of the *Passions* of the Soul; how they are concern'd in and wrought upon by Musick, giving us a *Table* of the several Musical Chordes suited to the several Affections. He concludes the whole with a large discourse of the Modern, both Church and other, Musick,

Now, whether this Author have by all these his Speculations and pains given a perfect *Scale of Musick* according to the true Proportions of Sounds, (which is the great *desideratum* in Musick,) we must leave to the judgement of the great Masters of Musick, especially to the judicious and extraordinarily skilful Musitian Mr. *John Birchensha*; who, it is still hoped, if he be competently encourag'd and assisted, will in due time publish to the world a Compleat System of Musick, after the method formerly taken notice of in these *Traacts*, *Numb. 90. p. 5153.*

II. *Georgii Wedelii M. D. Specimen Experimenti Novi, de Sale Volatili Plantarum, Francofurti, 1672. in 12°.*

THis Author endeavors to shew in this *Traact*, that by a peculiar way there may be drawn out of Plants a true and genuine *Volatil Salt*; asserting, that there is not only in Cephalick, Anti-scorbutick, &c. but also in those Plants that are insipid and accounted cold, a volatil Salt lurking. And this he offers to prove;

First, by the food of Animals, that live altogether upon Grasse, and such like herbs, and do abound in Volatil Salt; which he pretends is not made such by digestion, since to him it is not imaginable, that the Heat of Animals, or the Ferment of their innate Volatil Salt, is so multiplicative, as to diffuse and extend it self so far, as to prepare this Salt, and that so copiously out of Herbs supposed to have none such.

Secondly, Chymists are granted to draw hot Spirits out of cold: Why then should they not afford Volatil Salts, since ardent Spirits are akin to them?

Thirdly, the smoak and foot of herbs and wood punge the eye: Whence that but from a volatile Spirit?

Fourthly,

Fourthly, Wine abounds in Volatil Salt, and out of its *feces* such Salt is extracted.

Fifthly, Bread as soon as 'tis in the stomach, refreshes and recovers the faint, before any Chyle or blood is made of it; and even the steam of bread in the Oven is restorative. Whence else, but that the Volatil Salts, which are subtile and exceeding active and piercing, are darted into the Nerves, Veins and Arteries, and thereby suddenly relieve the indigent body?

Sixthly, he affirms to have obtained fine crystals out of *Quinces, Opium, &c.* which he can deduce from no other principle than that of Volatil Salt.

Seventhly, he saith, that he hath *actually* drawn from a certain herb a very fine Volatile Armoniacal Salt, without any additament that could be as much as suspected to participate in the least of any such Salt; and that he hath performed this without fire.

This done, he relates the several wayes used by others to draw Volatil Salt out of Plants; and on this occasion distinguishes two sorts of *Fermentation*, the one *destructive*, whereby the Form of the mixed bodies perishes, and which tends to Corruption; the other *Elicitive*, whereby parts latent are brought to light, and are extricated from the bonds that kept them imprisoned. And by this latter way he saith that the Volatil saline parts may be set at liberty and made to fly away.

And having declared, that by means of an Artificial fermentation Volatil Salt may be obtained out of Plants, more or less; he giveth this general direction about it, that they must be bruised, digested, and in due time (which is chiefly in the Spring) their Volatil Salt collected; referring particulars to a time, when he shall have verified this Experiment in more Plants, than he hath yet done.

To all this, he annexes the great Use of Volatil Salts extracted out of Plants, especially in almost all Diseases, for as much as they are able to dis-obstruct the pores of the Brain; discusse Lethargies and Apoplexies; afford to the Spirits a free passage through the nerves; recover faintings; remove hypochondriacal and hysterical suffocations; attenuate the blood; pass into the inmost recesses of the bowels, and open all obstructions there; depurate the blood, and what not?

He

He concludes the whole with four Chapters, whereof the *first* treats of the Pores and Figures of Volatil Salts, corresponding to those of the Brain, Heart, Blood, Nerves: The *second* compares Volatil Salt with Quicksilver, which he takes to be nothing else but a Volatil Salt: The *third* examines, whether Volatil Salts are contained in Mixts *actually* or *potentially*: The *fourth* inquireth, whether all Volatil Salts are of the same kind.

So much of this Author; whose way not being here made out and declared, we hope, a Learned and very knowing Member of the *R. Society*, Doctor *Daniel Caxe*, will shortly supply the world with that defect, he being certainly and experimentally master of a sure and easy way of extracting the Volatil Salt out of all sorts of Plants.

An Advertisement.

HEaring of great complaints of the *Rot* of Sheep in many parts of *England*; we thought, it would not be unwelcome to the Reader, to be, on such an occasion, directed, for a good and cheap way of preventing the disease, to what the Honourable *Robert Boyle* hath published in his second *Tome* of the *Usefulness of Natural Philosophy*, printed at *Oxford A. 1671. p. 15.* The short whereof is; That a great Sheepmaster lately preserv'd his Flocks in a moist Country, when most of his neighbours lost theirs; and that he did it by the bare use of (*Spanish*) Salt, of which each Sheep, being first made to bleed a little under the Eye, was made to take down a small handful, two or three times (with some days of interval,) without being suffer'd for some hours to drink any thing after it.

LONDON,
Printed for *John Martyn*, Printer to the *Royal Society*. 1674.

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